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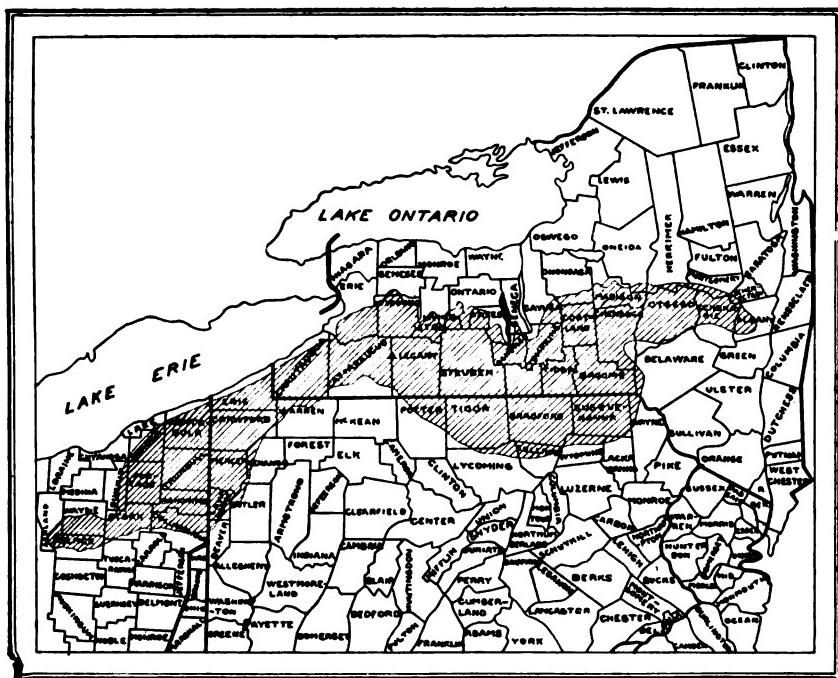


Fig. 1.—Sketch map showing the region occupied by Volusia Soils in Ohio, Pennsylvania and New York. (By permission of U. S. Dept. of Agri., Bureau of Soils, Bulletin No. 80.)

FIFTEENTH ANNUAL
REPORT

OF THE

PENNSYLVANIA

Department of Agriculture



1909

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**FIFTEENTH ANNUAL REPORT
OF THE
SECRETARY OF AGRICULTURE**

**DEPARTMENT OF AGRICULTURE,
Harrisburg, Pa., January 1, 1910.**

Hon. Edwin S. Stuart, Governor of Pennsylvania:

Sir: I respectfully submit my Seventh Annual Report of the operations of the Department of Agriculture of the Commonwealth of Pennsylvania, the same being for the year 1909 and the Fifteenth Annual Report of the Department.

AGRICULTURAL AND CLIMATIC CONDITIONS AND CROPS.

The mild winter of 1909 brought out the winter crops, such as wheat and grass, unharmed by any of its usual rigors, especially in the northern part of the State. The mild weather of March, unusual in most sections, gave the farmer opportunity to sow oats earlier than usual, as well as the northern varieties of peas; and in this way enabled him to advance one or two of his summer crops in harmony with the winter wheat and grasses. During part of March the weather was so warm for a number of days that fruit buds expanded to such a degree that the cold of April did considerable damage in many sections.

During the months of April and May there was a sufficient rain fall in most sections of the State to meet all demands; but the weather was somewhat colder than usual, which was desirable for wheat and oats, but not for grass and corn, and therefore these crops were considerably retarded which accounts for the unusual quantity of soft corn and a lower yield of hay than usual throughout the State.

The drought, which began in most of the Eastern and Central sections of the State with the end of May, continued with only here and there local showers to give a little relief, until late in September, and in many sections of the State a scarcity of water was experienced until winter set in and snow and rain brought relief. This drought in many of the richest corn and potato counties of the State reduced these crops to one-half and even less than half of their normal yield, while it did not do so much damage to the wheat.

The oats wherever sown during the favorable weather in March did well, but the later sowing, the whole growth of which came within the limits of the drought, did not yield so well.

Here is seen an advantage in diversified farming and crop rotation, because with this method of farming there are early, mid-summer and late summer crops growing, and if any one part of the season is unfavorable, all crops are not affected by it. Pennsylvania stands without a peer in this method of farming, now recognized to be the best in nearly all the states of the Union. With all these unfavorable weather conditions the crop yields were fully up to and some above normal.

MAIN CROPS OF THE STATE.

The crop estimates given here are taken from the United States Crop reports and are not as accurate as the Census Reports that will be taken in 1910; but they are sufficiently accurate for the purposes of this report.

CORN.

With weather conditions already stated as prevailing in the greater part of the State, during July and August, the corn growing months of this State, the yield would naturally be lower than that of a favorable season. The average yield per acre in the State for 1909 was thirty-two bushels, with an acreage of 1,525,000, yielding a crop of 48,800,000 bushels, worth December 1st \$34,160,000. A corn crop is grown within the limits of from ninety to one hundred and twenty days and is to the individual farmer the most valuable cereal crop he can raise. For this reason, when there is not a sufficient rain fall, it becomes necessary for the farmer, by proper cultivation, to conserve the moisture received from the early Spring and Summer rains. That this has been done by a number of farmers, is shown by the fact that the yield was only eight bushels per acre below that of 1906, which was the largest since accurate crop statistics have been kept. This yield, obtained under adverse conditions, shows that there is some good farming done in Pennsylvania. This is especially evident when we compare the yield of this adverse year with the yields of such corn growing states as Illinois, where the highest yield, that of 1902, was thirty-nine and eight-tenths bushels and the lowest in 1901, twenty-one and four-tenths bushels per acre.

Movements have been started in many sections of the State by farmers' organizations of various kinds, Corn Growers' Association, Boys' Corn Clubs, etc., for improving and increasing the yield of corn. Some Agricultural Societies of the State have purchased seed corn and sent out as high as sixteen hundred samples to as many different boys within their counties. The boys have grown the corn, and at the Fair, put it on exhibition where it was judged by an expert from this Department and as high as forty-six prizes were awarded, ranging from fifty cents to ten dollars.

The State Livestock Breeders' Association, for the last three years, has with its annual meeting held a Corn Show open to all corn

The competitive exhibits by the Agricultural Societies and Fair Associations and the State Breeders' Association, together with the work done by our Agricultural Experiment Station and the Farmers' Institutes, is developing such an interest in this subject throughout the State that there will be more careful selection of seed and better cultivation of this crop in the future, so that it is reasonable to expect that it will soon be increased by millions of bushels.

WHEAT.

This crop was not as much affected by the drought so prevalent throughout the State, because it had made about the whole of its development before the dry weather set in. The average yield per acre was seventeen bushels, which, with an acreage of 1,545,000, made a total yield of 26,265,000 bushels, worth December 1st \$28,629,000. Some of the best wheat soils in this country are located within this State and they only need development to show that such is the case. This work of development should not be neglected because the demand for wheat will never be less, but always greater, as people of all nations are adopting European and American methods of living.

This State produces about as much wheat as is consumed by its citizens. Assuming that in 1910 our population will be 6,500,000, with a wheat crop of 26,265,000 bushels there will be four and nearly a half bushels for every man, woman and child in the State. Wheat is about the only crop of which we produce, approximately, as much as we consume.

OATS.

Pennsylvania has throughout the Central and Northern tier of counties and on the higher altitudes of the mountains, which embraces a large part of the State, an immense acreage, admirably adapted to growing oats. Knowing this to be the case I regret having to report that during the year 1909 only 998,000 acres were sown with oats, giving a total yield of 25,948,000 bushels, or a little over twenty-five bushels per acre, worth \$12,274,000, yielding to the farmer, approximately, \$12.00 an acre for growing it; not very big pay. With so large an acreage adapted to the raising of this crop and with the great demand for it right at home in our own State and considering the comparatively short time it takes to grow it, it would seem that farmers should put forth an extra effort to develop this crop, to double the acreage and also largely increase the production per acre. This Department stands ready, with all the facilities at its command, to aid farmers in the work of making this one crop what it should be.

RYE, BARLEY AND BUCKWHEAT.

These three crops are of vast importance in Pennsylvania, because we have so many varieties of soil especially adapted to their production. Few cereal crops give better yield on the steep hillsides, of which there are so many in all sections of the State, than rye. It will endure colder and more rigorous winters than wheat and therefore is better adapted to Northern sections. It can be sown late, even so late that sometimes it fails to come up in the Fall. The first warm days after the frost is out of the ground will germinate,

and a fair crop may be expected. The total yield for 1909 in this State, from 360,000 acres, was 5,508,000 bushels, or 15.3 bushels per acre, worth December 1st \$4,406,000.

Barley seems to be regarded as a very unimportant crop in Pennsylvania. Only 9,000 acres were sown with this grain in 1909, yielding 196,000 bushels, worth December 1st \$131,000, averaging 21.8 bushels per acre.

The production of buckwheat has been steadily increasing in this State, and as its superior qualities as a feed for all kinds of farm animals, including poultry, and for man also, will become better understood, more and more will be raised. It will yield more bushels to the acre than any of the cereals on poor soils. In fact, it will not yield a large crop on rich soils for the reason that all the growth goes into the straw which is likely to fall down before the grain matures. It grows in a short season and therefore is a good crop to be introduced between two winter crops, as for instance, a crop of early hay can be harvested, the ground ploughed, sown with buckwheat, a crop of buckwheat raised and a seed-bed prepared and wheat or rye sowed and the soil greatly improved thereby. 290,000 acres were sowed with buckwheat in 1909 in this State, which yielded a total crop of 5,655,000 bushels, or 19.5 bushels per acre, worth December 1st \$3,845,000.

HAY.

There was a slight increase in the tonnage of clover and timothy hay per acre during the years 1904, 1905, 1906, 1907 and 1908, while in 1909 the tonnage fell back to that of 1899, ten years ago. The tonnage has about kept pace with the increase in acreage which has followed the clearing away of the forests. The acreage should be larger than it now is, and the tonnage per acre should be increased also, because with the better methods of farming and the sowing of good pure seed, all of which have been advocated by this Department, the tonnage should not be less than a ton and a half per acre. This is not said in the way of criticism but because such an increase is a necessity as we shall endeavor to show later. The average yield per acre in 1909 was 1.2 tons on an area of 3,118,000 acres, the total yield being 3,742,000 tons, worth December 1st \$54,633,000.

POTATOES.

This Department has long recognized that the yield per acre of potatoes should be larger than it now is, and with this as the object, the Department had a bulletin prepared several years ago by one of the most successful potato growers in the country, of which several thousand copies have been distributed among the farmers of the State, giving the best methods known for producing this valuable crop. With the extremely dry season of 1909, the yield per acre in this State was seventy-eight bushels, which, with an acreage of 305,000, gave a total yield of 23,790,000 bushels, worth December 1st \$15,464,000.

NUMBER OF FARM ANIMALS AT THE END OF 1909.

At the end of 1909 there were in the State 1,140,000 head of milk cows; 1,112,000 head of sheep; 917,000 head of other cattle; 931,000 head of hogs; 619,000 head of horses and 43,000 head of mules.

A COMPARISON OF THE CROPS PRODUCED, WITH THE FEED REQUIRED BY THE ANIMALS OF THE STATE.

During 1909 there was produced in the State 48,800,000 bushels of corn; 25,948,000 bushels of oats; 5,508,000 bushels of rye; 5,655,000 bushels of buckwheat; 196,000 bushels of barley, making a total of 86,107,000 bushels, or a little over eighteen bushels of grain per head for all animals, not including poultry.

If the corn were fed to the milk cows of the State it would give each cow approximately forty-three bushels of corn per year of 365 days or about six and one-half pounds of grain per day, barely enough for the cows, to say nothing of the other cattle, sheep, horses, mules, hogs and poultry. If all the oats, rye, buckwheat and barley, a total of 37,307,000 bushels were fed to the horses and mules it would furnish 57.3 bushels for every horse and mule or a peck a day for two hundred and twenty-six days, not enough for the horses and mules, and the hogs and sheep and poultry would be entirely without grain.

In the case of roughage, the State is a little better equipped. In 1909 we raised 3,740,000 tons of hay. This, as already intimated, is about an average crop for ten years ending with 1909. We had 1,525,000 acres in corn, which is more than an average acreage, and if we raised two tons of fodder per acre we would have 3,050,000 tons, or a total roughage from these two sources of 6,790,000 tons. If this roughage were fed to the milk cows, other cattle, horses and mules it would furnish 5,000 pounds of roughage a year for each of these or at the rate of thirteen pounds a day for 365 days. If these animals were pastured half of the year, which is in no wise the case, and we would multiply this roughage by two, it would give us approximately enough for all animals, including sheep. From this it is evident that if we want to increase the animals on our farms we must greatly increase the roughage.

FEEDING REQUIREMENTS.

It requires between twenty-four and twenty-five pounds of dry matter containing from fourteen to fifteen pounds of digestible carbohydrates and fats and about two and twenty-five hundredths pounds digestible protein to furnish a daily ration for a cow weighing 1000 pounds. If the dairymen of the State were obliged to get this ration within the State they would likely use about fourteen pounds corn stover, eight pounds clover hay, six pounds corn meal and three pounds wheat bran, which would make a wide ration. As already stated, the corn crop would furnish the corn ration for these cows providing there were no other animals to be fed; and if the cows were pastured about six months in the year and fed no other roughage, the hay and corn fodder would furnish the roughage; but how about the wheat bran? The average wheat crop for ten years is 26,421,526 bushels. If thirty per cent. of this is bran and middlings, the wheat raised in Pennsylvania would furnish 237,793 tons of the bran needed to feed the dairy cows a year. 1,140,000 milk cows fed at the rate of three pounds of bran a day for 365 days will consume 624,150 tons or 386,357 tons more than is furnished by the wheat, worth at \$25.00 a ton, \$9,658,925. This amount would supply what is needed to feed the dairy cows alone and there would be no grain for other cattle, sheep, hogs and poultry. The sheep, other cattle and hogs together number 2,960,000 and if these, using bran as a grain food, were fed six pounds of bran each day, for the year of 365 days, to furnish this

grain ration 3,241,200 tons would be required worth at \$25.00 a ton \$81,030,000. Adding to this the \$9,658,925, we have \$90,688,925, or what would be \$404.00 for every one of the 224,000 farms in the State. This gives us some idea of the immense amount of money expended by the Pennsylvania farmer for concentrated feed stuffs annually.

I have stated that the average yield of wheat for the ten years ending 1909 was 26,421,526 bushels, an average of 16.5 bushels to the acre. Only two state in the east, to my knowledge had a higher average yield than this, while the production in ten of the new Western states was above these figures. In 1900 the State of Pennsylvania had a population of 6,218,955 and it is reasonable to suppose that the census of 1910 will show our population to have increased to 6,500,000 at the lowest estimate. With a population like this to feed and with the amount of wheat above given, we have a little over four bushels for every man, woman and child in the State, probably not sufficient because statistics show that the consumption varies between three and a half and six bushels for the individual.

The great shortage is in our production of feeding stuffs. The feeding stuffs now brought into the State could all be produced at home, the roughage could be nearly, if not quite, doubled and twice as much wheat could be raised as is now produced. This is a condition for the relief of which something must be done and for the improvement of which this Department is exerting itself to the utmost of its ability, with the facilities at its command, which are limited to Bulletins, Lectures, Farmers' Institutes, Movable Schools, etc.

DAIRYING AND RAISING CROPS FOR THE DAIRY.

The Dairying of the State is confined largely to the Northern counties and the counties that are more or less close to our larger cities. In the first case named, dairy farming is followed because of natural conditions favoring it, and in the second case, on account of favorable markets. In the former case it is usually butter dairying as in Bradford county, which is one of the most noted butter producing counties in the United States, furnishing large quantities for the United States Army and Navy, while the counties close to the cities do milk dairying to furnish this commodity for the cities close by. This is as it should be because the cost of transportation is small and the milk can be delivered to the consumer without much outlay. From the butter dairy, little if any fertility is sold from the farm, while from the milk dairy large quantities, especially of nitrogen, are sold and unless the milk dairyman improves the advantage he possesses of being able to purchase large quantities of manure and returning it to the farm, his land must depreciate in productiveness.

With the butter dairy and milk dairy a considerable distance from the market, the question within recent years has been how to supply the kind of feeds to make the largest quantities of butter and milk in the cheapest way, and at the same time keep up the fertility of the soil. When wheat bran, buckwheat middlings, gluten meal, gluten feed, linseed and cotton seed meals were cheap, feeds containing large percentages of nitrogen, the ingredient to make milk could be purchased and the nitrogen sold in the milk was easily replaced. This being the case the farmer got so in the way of buying these feeds that it is difficult for him to get away from it and undertake to raise feeds on his farm to take the place of the now too expensive con-

centrates. The subject of raising the nitrogenous crops so important to dairy feeders needs careful study as what does well in one section will fail in another section. In the northern and higher elevations of the State the Canada field pea and alfalfa will do well while in the southern and lower section the cow pea and soja bean, as well as alfalfa, thrive, every one of them being nitrogen gathering crops.

The Canada field pea is best sown with oats at the rate of a bushel and a half of peas, sown at a depth of two and a half to three inches, with a bushel and a half of oats sown about an inch deep, at the same time the peas are sown, or two bushels of peas and a bushel of oats can be sown in the same way, if more peas are desirable.

The peas and oats, if cut when the oats crop is fully developed and the grain is still soft and not milky, and made into hay, will furnish the roughage now furnished by the depleted pastures of our northern counties while at the same time furnishing the protein contained in the expensive concentrates; or the peas and oats can be let ripen and the grain threshed out and the grain ground together to be fed as the grain ration, with or without corn, and the straw fed as roughage to horses, cows and other farm animals.

CROP ROTATION FOR DAIRYMEN.

On many dairy farms in the State permanent pasture lands are to be seen that by long usage without tillage have become quite unproductive. A rotation suggested to build up the soil of such lands can be arranged by deep plowing and thoroughly pulverizing the soil early in the spring and as early as possible sowing with Canada field peas and oats as already suggested. After the combination crop of field peas and oats is harvested, the soil is again plowed, unless it be a sandy soil when it need only be thoroughly cut up and prepared with disk harrow, and sometime in September sowed with winter vetch and rye, at the rate of not less than three pecks of vetch seed and about the same quantity of rye to the acre. This crop will furnish soil protection for the winter and can be plowed down early in the spring and the field again sowed with peas and oats, or it can be allowed to grow until in May and then plowed down and the field planted with corn; or what may be still better, the rye and vetch crop can be made into hay and the stubble plowed down and the field planted with corn for silage, or where the season is long enough, the corn can be allowed to ripen and be harvested for the grain and the fodder and the rye and vetch hay used for roughage. After the corn is harvested, if it be an early variety, the field can be again sowed with rye and winter vetch, which can be plowed down the following spring, or what may be better, made into hay as before and the field sowed with alfalfa in the latter part of June or the beginning of July in the northern section of the State. Alfalfa is named because with the rotation suggested, of Canada field peas and oats, followed with rye and winter vetch, followed by corn, and the corn again followed by winter vetch and rye, and the rye and vetch with alfalfa would give the farmer a legume crop every year with a corn crop included for good measure. The alfalfa should not be allowed to remain on the field longer than three years. Two years would perhaps be preferable, when the field should be plowed up for corn and the rotation changed. Instead of sowing Canada field peas, as recommended for the old sod, plant corn

on the alfalfa sod and follow the corn with Canada field peas and oats. A ton of alfalfa hay, when properly made, is worth as much as a ton of wheat bran, such as is usually bought in the markets. Here is a roughage that will supply the protein of the high priced bran and which with corn, Canada field peas and oats, ground together, will furnish all the nitrogenous food needed by the animal to make milk and butter.

In the southern and lower lands of the State cow peas and especially soja or soy beans will do better. Soy beans, when planted sometime about the middle of May, in rows from sixteen to thirty inches apart, depending on the fertility of the soil, and the seeds from an inch to an inch and a half apart in the row, can be cultivated and will ripen or be ready for the silo when the corn is ready for the silo. This method of cultivation will not only improve the old permanent pasture lands but will furnish feeds that will take the place of the costly concentrated feeding stuffs now purchased by so many dairy farmers.

THE SILO.

The method of storing feed in the silo has become more and more satisfactory to the farmers of the State, except in sections where certain Milk Manufacturing or Concentrating Companies have tried to induce farmers not to feed silage. This Department, through the lecturers and instructors it employs, has endeavored to show the fallacy of the theory that silage fed to dairy cows has an injurious effect upon the product and at one of the open meetings held under the auspices of the Department these objectors to the feeding of silage were so completely routed that they left the meeting, abandoning those whom they had induced not to feed silage to the mercy of the silage defenders.

The growing of the most satisfactory silage crops and the cheapest way of preserving them are questions that have not been worked out as satisfactorily as might be, for this reason it is suggested that legumes, such as soja beans, be siloed with corn and that they be grown, wherever possible, near the silo to cheapen the harvesting and storage and to make a better quality of silage. A rotation to do this in the southern section of the State is suggested by having a field as close to the silo as possible, sufficiently large to produce the quantity of material to fill the silo and dividing this field into two parts, raising corn on one section one year and soja beans on the other, and the next year reversing the order and after these crops, let there be a catch crop of crimson clover or rye or winter vetch to be plowed down in the spring for humus and fertility, and the crop alternated as already indicated.

SYSTEMS OF FARMING.

With the system of farming here outlined adopted in this State, including the use of the silo, the production of such crops as the mangel-wurzel to furnish succulent food and the raising of sufficient roughage of a superior value and grains containing the protein contained in the concentrated feeds, the necessity of purchasing the commercial feeding stuffs that now cost the farmers of this State about \$90,000,000 annually will soon be abolished.

The aim of the Department is to induce the production of more feeding material in our own State in order to solve the now perplexing problem of how to raise a larger number of cattle and swine to aid in supplying the teeming population of our mining and manufacturing communities with better and cheaper meats.

ANIMALS AND HIGH COST OF LIVING.

It has already been seen, from the statistics referred to, that of the 49,379,000 other cattle than milk cows in the United States in 1909, Pennsylvania had only 917,000, while such sparsely settled states as Texas, Kansas, Missouri, Nebraska and Iowa had from a little over seven million down to nearly two and a half million per state; and of the 4,154,000 hogs in 1909, Pennsylvania had 931,000, while land on which cattle and hogs can be raised is as cheap in this State as in the states referred to. From what has been stated it is reasonable to suppose that more hogs and cattle would be raised in Pennsylvania if there were more feeding stuff in the form of roughage and grain raised in the State. Farmers are unwilling to buy the expensive feeds and run the risk of feeding hogs and cattle for the markets at our door, but if they could be induced to raise the feed, the increase in the number of hogs and cattle would naturally follow.

The cry of the high cost of living is wide as the nation, and among the laboring classes of our State it has been raised Heaven high, and it is certainly important that every one capable of doing anything to relieve this condition should work with that end in view. One individual can do but little; but the efforts of many directed in the same line can accomplish much.

To all the foods and feeding stuffs brought into the State is added the cost of transportation, which, in many instances, is excessive, and to this is added the profits of a number of agents and middlemen. This method of overcharging has, in many instances, become so flagrant that the Secretary of the National Department of Agriculture has sent his agents into some of our cities to investigate conditions and they have reported that in one of the cities of this State fifty per cent. is charged over and above the cost to the dealer and in several cities from twenty-eight to forty-seven per cent. above the cost is charged by butchers and dealers in meats.

In a city of our own State where a profit of fifty per cent. is charged by the dealers, the cost of meat to them is seven and a half to eight and a half cents, showing that the farmer is not receiving a proportionate share of the excessive cost to the consumer.

These excessive prices have another effect, that of reducing consumption of meats which is very evident from statistics at hand. In 1900, excluding all inedible parts, the average consumption of meats was 182.6 pounds, whereas in 1890 seven-tenths of a steer was consumed by the average individual per year. If, as is evidently the case, there is a decline in the consumption of meats, then the Departments of Agriculture, of the Nation and the various States, should know why this is so, and this Department stands ready to join in such an investigation. If the number of cattle in this State in 1909, exclusive of milk cows, and the number of hogs also were slaughtered and the average weight of the cattle should be 600 pounds and the weight of the hogs 200 pounds, and if there was no increase in popula-

tion since 1900, the date of the last census, there would be only one hundred and eighteen pounds of meat for every individual in the State, or 64.6 pounds less than the average consumption in the United States in 1900.

The high prices are not only showing these effects in home consumption, but also in the export trade, because the exportation of meats in 1909 was 43 per cent. less than in 1906, the high water mark year in meat exportation. These conditions show the serious effect of some elusive influence in operation that can but result in injury to the agricultural industry in many ways; but especially in the maintenance of the fertility of the soil, which is one of the most important questions of the period in which we live, for it is through the feeding of animals and the right use of *excreta* that fertility is maintained.

SOIL FERTILITY.

When large quantities of fertility are sold from the farm, as in the case of the milk dairy, where the milk is taken to the city and sold, there may be a good reason for buying concentrated feeding stuffs, because there is a double advantage to be derived from so doing, the increase in the quantity of milk and the fertility brought to the farm by way of the manure. This is especially so where the milk is shipped from territory far away from the cities as is now done in this State and New York and to which it is impossible to ship back the large quantities of manure made in the city. This is one of the many reasons why, wherever conditions are favorable, milk dairying should be encouraged near towns and cities, because to these localities the large quantities of manure can be returned, and after we have learned how to take care of the sewage of these cities, the greater part of the immense amount of fertility taken directly out of the soil will be returned to it. This phase of the fertility cannot be solved by the farmer and should be taken up by State and National Departments of Agriculture, as well as the Agricultural Colleges of the country, not merely from a sanitary standpoint, as is now done, but from the point of the loss of fertility. In solving the question, the Health and Agricultural Departments of the several states should unite. If the sewage of the large cities of this Commonwealth could be put into such condition that it could be handled by the farmer, as he now handles his commercial fertilizer, it would solve the fertilizer question for the State and place fertilizing material in the hands of the farmer at much less cost than results from the use of the commercial fertilizers that are now regarded as quite indespensable.

Another thing affecting the maintenance of fertility, which at the present time is quite common, is the washing away of the soil and its fertility by erosion. As the organic matter in the soil decreases, the erosion increases. When the country was, to a large degree, covered with forests, even during the most extensive floods, the water of our rivers, though somewhat cloudy, was not muddy, as it now is, because the organic matter present held back the soil and also the fertility, to a large degree, because it was locked up in organic combinations which are insoluble in water. The method of agriculture already outlined will help to increase the organic matter in the soil, and in this way prevent the erosive action of the water as well as help to retain a large quantity of the water in the soil for the use of plants when dry weather prevails.

It is apparent to any close observer, that the organic matter in our soils has been reduced and that the moisture coming from the snows of the winter and the rains of the spring are not held as they were when forests covered the State and before the organic matter was reduced as it now is, and that this water, so much needed for crop production, enters our streams early in the season and flows away, creating floods that do great damage along their course by covering fertile soils and destroying other property. The various operations so destructive to soil and soil fertility by covering up the fertile soils and washing away plant food are brought about by the cutting away and otherwise destroying our forests; and as we are dependent for existence upon the soil and its fertility, it behooves the State to do something to prevent the agencies now at work from destroying the source of her own existence. Reforestation and the prevention of forest fires are of first importance among the preventive agencies to be employed, and the Forestry Bureau of the State and the Department of Agriculture should work hand in hand in their effort to remedy the evils referred to.

Another menace to soil fertility comes from the extensive mining operations in the State. In many cases the coal veins are mined from under the surface, leaving supports of coal until a certain section has been mined out, when these supports are also removed and the superincumbent rock is allowed to sink. In the case of a vein of coal being close to the surface, this subsidence takes place in a comparatively short time, while, where the mining has been done a hundred or more feet below the surface the subsidence goes on slowly. Whether this subsidence takes place slowly or quickly, its effects are detrimental to agriculture. In the former case the surface is so broken and filled with what may be termed sink holes that it is dangerous to cultivate, and when cultivated, the rain soon sinks beyond the reach of growing crops and the capillarity so deranged that little of this water can come up for the use of plants, and in this way much of the soil is rendered permanently useless. In the latter case, where the subsidence takes place slowly and where little, if any, derangement of the surface occurs, the water gets away, because in many places, when mining operations begin, water courses in the earth are changed and the water carries with it, as it passes through the soil, large quantities of fertility which capillary action never returns. If permanent supports for the surface could be provided from the waste material of the mines, after the coal is removed and the mines were completely closed up, nature would proceed to readjust the temporary disturbances, and in time this soil would be restored to its first condition of usefulness.

Another agency of soil destruction, especially in the southwestern section of the State, comes from the fumes, gases and soot of coke ovens. These ovens are located largely in the vicinity of Pittsburgh, where the products of the soil are costly and where there is a large demand for them, and therefore the greater reason to stop the nuisance. There is no longer any question in scientific circles but that from these gases and fumes, substances, such as ammonia, especially valuable in agriculture, can be profitably extracted as well as other valuable substances susceptible of being utilized. The passage of an Act of Assembly regulating the manufacture of coke so as to prevent

the effect produced upon the soil by the distribution of the soot and gases coming from the ovens would, I believe, prove beneficial to agriculture in more ways than one.

CROPS ADAPTED TO SOILS.

The United States Bureau of Soil Survey has made a number of surveys in the State to demonstrate, if possible, soil adaptation to the raising of crops suited to the large markets within the reach of certain producers. This work is especially beneficial within the cheap transportation limits of our large cities, because wherever soils are adapted to the raising of vegetables and general market gardening there is within such limits excellent opportunity for making profits by the farmer and at the same time cheapening these products for the consumer. Along this line of work Pennsylvania, although doing more than is done by a majority of the Northern states, is not furnishing to the mining and manufacturing sections of the State the quantity of these products that she is abundantly able to furnish and which she should in justice to her agricultural interests provide.

That these vegetable products are being shipped into the Pittsburg district by train loads, is a fact well known to every farmer of the district. These vegetables are raised on soils no better, and in many instances not as well adapted to raising them as are thousands of acres within this district and within easy and cheap reach of it. The time has come when the farmers of this district must raise more of the foods consumed within its limits, or prices must rise to such an extent as to seriously affect its industries. That it is possible to do this, is evident from the character of the soils within the district.

One of the varieties of soil found in this district is Brook-Clay loam. The largest areas of this soil are in Fayette county, the southwestern part of Westmoreland and the northern part of Washington counties, with local areas in Greene county. On these soils, before the soot and fumes of the coke ovens destroyed large acreages of it, Kentucky blue grass furnished the best kind of pasture for the extensive stock raising industry in this section, which in a few localities is still kept up. A combination of this grass with alfalfa makes the best kind of pasture for all kinds of farm animals, but especially for dairy cows. These soils are adapted to the production of alfalfa, Canada field peas and oats, and in Greene and Fayette counties soja beans and cow peas can be grown, and with the ability to raise as good crops of corn in this section as can be produced anywhere in the State, with markets for all dairy products close at hand, the farmers of this section have unusual opportunities for success in this business.

But there are other varieties of soils in this district, as well adapted to potato growing and market gardening as are the Brook-Clay soils to dairying and stock raising.

The DeKalb series, composed of the DeKalb silt loam, the DeKalb loam and the DeKalb clay loam, occur in Jefferson, Clarion, northern Indiana and Armstrong counties and extend northward to the Glacial line. These soils are well adapted to potato growing, as has been demonstrated by some growers who have raised as high as three hundred and fifty bushels per acre on an area of twenty and more acres. These soils are not only adapted to potato growing, but also to producing cabbage and onions, and for all these crops there is an enormous demand in this district.

Another series, called by the survey, the "Westmoreland soils," predominate in Greene, Beaver and Allegheny counties and are associated with the Brook or Limestone soils in Fayette, Westmoreland and Washington counties and extend into southwestern Indiana, southwestern Armstrong and Butler counties. The Westmoreland loam and silt loam occur in fairly level and gently rolling areas in the western half of Fayette and the eastern part of Greene counties and in the vicinity of the towns of Washington, Mount Pleasant, Greensburg, Indiana, Cochrans Mills, Elderton, Elders Ridge, Kittanning, Butler, Harmony, Mars and Evans City and in the Conoquenessing and Ligonier valleys as well as west of Beaver Falls. These soils, especially the sandy series, are very well adapted to raising early vegetables, and it will be observed that they are sufficiently close to railroads and larger and smaller cities and towns, as well as to Pittsburgh, to make personal delivery possible so that family trade with regular customers, which is always the most profitable, can be established.

This phase of the Agricultural Industry is still in its infancy in our State; but the Department, by bulletins issued and through the Farmers' Institute work, has been endeavoring to induce farmers in the various localities of the State to raise the crops for which their soils are best adapted and for which they have the best market. In order to do this more efficiently, the Department should have under its control a number of small farms, located at different points throughout the State, adapted to grain farming, hay raising, dairying, market gardening, potato growing, etc., and within a certain limit of time the party to whom the management of these farms is entrusted should be obliged to show such financial returns and such an improvement of the soil as demonstrate, by the actual doing of the thing, what can be done along agricultural lines in its various branches in this State and in this way help to solve the high cost of living. It is to be hoped that at some time in the future the appropriations made to the Department may be sufficient to make the introduction of such a system possible.

REPORTS OF DIVISIONS OF THE DEPARTMENT.

BUREAU OF FARMERS' INSTITUTES.

This Division has been the right arm of the Department in carrying forward its plans for the advancement of agricultural activity in the State. The institutes and the movable schools, which latter have been recently inaugurated, continue to grow in favor and are bringing the College to the farmer, and everywhere the results of the good work that is being done are to be seen. Through this agency we reach not only the wideawake, intelligent tiller of the soil, but we reach and are able to interest the man who does not read and who is not accustomed to formulate his plans so as to work according to any system from which it is reasonable to hope for success. The Institute Lecturer calls attention to the great subject of soil fertil-

ity, and how nature maintains it. He shows the farmer that he must not work for cash returns only, but also to maintain the fertility of the soil and thereby provide for the support of generations that are to come. The farmer gets an idea of the benefits of cultivation, the benefits of air and moisture in the soil and how by the use of pure seed on well prepared ground, under normal conditions, a large crop follows, while with poor seed and poor soil preparation poor crops are the inevitable result.

Along the line of various industries on the farm, it is made plain to the farmer that ten cows, each giving 9,000 pounds of milk a year, are as valuable for dairying as thirty cows, each giving only 3,000 pounds a year, and that the less number will require less feed and only about one-third the care.

The raising of crops, such as alfalfa, wherever feasible, Canada field peas and oats in the north, soja beans and cow peas in the southern sections, to furnish feeds rich in albuminoids for feeding these cows, as well as for other animals, is urged and the reasons for the same given.

Specialties, such as cattle, swine and horse raising and the poultry industry, are urged wherever it is found that conditions are favorable and that markets are suitable for these industries.

But over and above all is the educational influence of the Institute. As already stated, the Institute brings the farmer to demand, that elementary agriculture be taught in the country school and that such text-books shall be introduced as will give the boys and girls instruction in agriculture, agricultural arithmetic, agricultural literature, agricultural geography, and wherever possible, chemistry and geology, as well as instruction in the culinary arts and in home making, all of which will bear fruit in the years to come.

The appropriation made by our General Assembly for this work is a very small amount when compared with the good accomplished by the Division. The full report of the Director of Farmers' Institutes is forwarded herewith.

DAIRY AND FOOD BUREAU.

With the transition of this country from being almost a purely agricultural nation, to the greatest manufacturing people in the world, the old fashioned manner of living and the preserving of foods has changed, and the manufacturer of food products has become a necessity. As manufacturing industries advanced, wealth increased; and with this increase in wealth there came more advanced ideas of living, demanding that the fruit and vegetables and the highly nutritious edible legumes, such as beans, peas and lentils and the various varieties of corn, should be preserved in the easily digested, delicately flavored and highly nutritious condition in which man receives them from the hand of nature. But with manufacturing, not only came increases in wealth; but because of it, the aggregation of our population in our cities became so great that former methods of preserving food became inadequate and new methods were demanded and canning of all kinds and varieties of foods came into vogue. This congestion continued to increase until there were not sufficient facilities for cooking and, in many instances, no one to do the cooking, and the food had to be canned already cooked. A little later, with the onward

rush intensified, there was no time to masticate and digest the food and it had to be "predigested"; and with all these varieties of demands the food manufacturer came and with him the unscrupulous doper, adulterator and poisoner came, for it is now as ever, "When the Sons of God appear, Satan also appears with them." To hold up these adulterators and poisoners, the states and the nation were obliged to enact laws and to establish departments for regulating food preservation.

According to the National Pure Food Law there are two kinds of adulterations; 1st those which are injurious to the health of the consumer; and, 2nd those that are not unwholesome but which debase the character and value of the food.

A Board of Experts authorized by Congress has been appointed by the President, from the members of the Society of Official Agricultural Chemists of the United States, to construct a standard of all foods entering interstate and international commerce. When these standards have been fully agreed upon, legislation should be enacted by each state harmonizing the food standard of every Commonwealth with the National standards. Without such standards Dairy and Food Departments cannot always enforce the laws with equal justice to all.

Our Dairy and Food Bureau carried forward the work assigned to it, during the year, with its usual activity. Its operations against the violators of the oleomargarine laws of the State are worthy of special note.

The full report of the Dairy and Food Commissioner is forwarded herewith.

BUREAU OF ECONOMIC ZOOLOGY.

The increased interest in the subject of fruit growing in this State has, within the last few years, greatly increased the necessity for active work of this Bureau. To conduct the operation necessary to enable the Chief of the Bureau to answer the vast number of questions that come to him, relating to insect pests and the methods to be employed for their destruction, is by itself a Herculean task.

The demonstration given by agents of this Bureau of methods to be employed for the preservation of orchards and the increase of their fruitfulness, covering nearly the entire State, have resulted in an incalculable amount of good and are greatly appreciated by the fruit growers of the Commonwealth who have been benefitted to the amount of many times the sum appropriated by the General Assembly to make this work possible.

Liberal appropriations are recommended to carry on the work of this Bureau in the future.

A full report of the Economic Zoologist is forwarded herewith.

REPORT OF THE BUREAU OF CHEMISTRY.

In harmony with the demand for pure and undebased food legislation for man, came a similar demand when it was found that adulteration and debasing of foods for animals was practiced, as already indicated in this report. The farmers of this State did not raise a sufficient amount of feeding stuff for our animals and therefore it became necessary to bring into the State from beyond our borders,

feeds to supply this deficiency. All feeding stuffs are composed of carbohydrates and fats, which furnish the fat, heat and energy of the body; and protein, which enters largely into composition of the blood, the lean meat, the muscles, the milk, hide and hair, and the crude fiber which serves largely as an agent to help carry away the waste of the body. The substances of which these foods are composed are digestible and indigestible and, as already indicated in this report, to get the best results from the food fed to our animals, the digestible carbohydrates, fats and protein must be fed in a ratio of about one to six, one of protein to six of carbohydrates and fats, and to do this intelligently the farmer must know the digestible composition of the feeds he buys, and if the Bureau of Chemistry would do nothing more than give the farmer this information concerning the feeding stuffs for sale in this State it would amply justify its existence.

Most farmers raise more crude fiber than they need, and sometimes more of the carbohydrates and fats than are needed are raised, but it is seldom that enough protein is raised. This protein is usually bought in gluten meal, gluten feed, linseed meal, cotton seed meal, Brewers' grains, Distillers' grains, wheat bran and middlings, buckwheat middlings, pea, bean and peanut meals, etc., all of which contain high percentages of protein, the substance that the farmers, and especially those engaged in dairying, need; and to the analysis of these feeds and their mixtures the time of the Bureau has been largely devoted during the year.

The agents of the Bureau during 1909, visited three hundred and thirty-one towns and cities of the State and collected thirteen hundred and seven samples of feeding stuffs, all of which were analyzed chemically and microscopically and reported to the Secretary of Agriculture and the manufacturers and dealers from whom they were collected.

In accordance with a suggestion in my report for the year 1908, the Legislature provided that the dealers in feeding stuffs doing business in this State, in order that they may properly guarantee their feeds may have them analyzed for a small fee. From this source three hundred and twelve samples were received during the year, which were analyzed and results reported to the parties sending the same, and in many instances the feeding value and the nutritive ratio of these feeds were also furnished.

As the result of the strict enforcement of the law enacted by the last Legislature, prohibiting adulterants, such as oat hulls, ground corn cobs, flax plant refuse, elevator chaff, cotton seed hulls, ground corn stalks, rice hulls, peanut hulls, weed seeds, etc., a number of feeds have been driven out of the markets of this State.

More than thirteen hundred samples of feeding stuffs were collected during the year by agents of the Department and analyzed, resulting in fifty-seven prosecutions for violations of the Feeding Stuffs Law.

In compliance with the provisions of the Paris Green Law, the De-

samples were found not complying with this requirement; but upon notification of the violation of the law, the labels were promptly attached by dealers.

Two hundred and seventeen samples of raw and boiled linseed oils were also secured, all of which were analyzed. Of this number ten were found to be adulterated, containing from four to twenty-five per cent. of foreign oils, mainly coal oil.

The work done by this Bureau is of great importance to the farmers, as well as to all owners of live stock, in the State, and the specific appropriation provided by the Feeding Stuffs Act is yielding a rich return.

I forward herewith the full report of the Chief Chemist of the Department, who is in charge of the work of the Bureau.

FERTILIZER CONTROL.

The Act of March 25th, 1901, having been repealed by the Act of May 1, 1909, which becomes effective July 31, the work of this Division was somewhat obstructed during the year, owing to the fact that prosecutions could not be brought in some cases where the analysis of samples of fertilizers, collected by agents of the Department, showed a deficiency in the fertilizer ingredients they contained. This change also affected the administration of the law, where fertilizers were found to be offered for sale and sold without Sections 1 and 2 of the law having been complied with. Of the later violations there were but five; four of which were adjusted by the offenders paying the license fees and registering their fertilizers with the Department as required by law. The remaining case was withdrawn, after information was made, upon the defendants agreeing to adjust the matter complained of with the Department.

During the year fourteen sampling agents of the Department visited fifty-four counties and secured 2787 samples of fertilizers, of which 1053 were subjected to separate analysis. The remaining samples represented brands of which more samples were drawn than were needed for making up composite samples for analysis, which resulted from several agents securing samples of the same goods in different sections of the State.

Sampling agents are commissioned for a period of one year, and when their work proves satisfactory they are re-commissioned, and before beginning their work each season, Spring and Fall, they are required to file with the Department an affidavit setting forth that they are not interested in any way in the manufacture or sale of commercial fertilizers, and that they will perform their duties with fidelity and in accordance with the requirements of the law and the instructions of the Department.

The practice of the Department heretofore has been to analyze separately, the goods of foreign manufacture, but by an arrangement with the Pennsylvania Experiment Station, by whom all fertilizers are analyzed for the Department, such goods are now composited, the same as goods of domestic manufacture, and the composite samples are made of goods drawn in different sections of the State. The former practice resulted in the analysis of the fertilizers sold in a particular locality only. In instances where deficiencies have been noted in these composite samples a separate analysis is made of the reserve portions of each of the samples represented in the composite

sample, and the deficiency is traced to the particular sample or samples represented in the composition analyzed. This extra service is performed by the Experiment Station without additional charge to the Department.

The new "Fertilizer Law" provides, in addition to the requirements of the former law, that "No person shall sell, offer or expose for sale, in this State any pulverized leather, hair, ground hoofs, horns, or wool waste, raw, steamed, roasted or in any form as a fertilizer or as an ingredient of a fertilizer or manure, without an explicit statement of the fact; said statement to be conspicuously affixed to every package of such fertilizer or manure and to accompany and go with every lot, parcel or package of the same."

During several former sessions of the Legislature efforts were made to have laws enacted which would compel manufacturers to state, upon the package, the substances composing the fertilizer it contains, but this proposed legislation was strenuously opposed by some manufacturers, which finally resulted in its defeat.

The section of the new Act above quoted meets, a part, at least, of the ends sought by those urging such legislation, as it enables the purchaser of fertilizers to discriminate between such as contain nitrogen in a soluble and readily available form and those that receive their nitrogen from substances that are insoluble, which renders it of little value for plant food.

During the year the Department received \$24,495.00 from fertilizer manufacturers, dealers and importers for fertilizer license fees, which was paid into the State Treasury and credited to the Fertilizer License Fees Account as provided by the original Fertilizer Act.

The returns of the sales of fertilizers in this State during the year 1909 show that 270,018 tons were consumed. It must be stated, however, that this amount does not represent all of the fertilizers used in the State during the year, owing to the fact that in many instances farmers order their fertilizers from manufacturers located in other states and where the sale is made directly to consumers, the Department cannot enforce the payment of the license fee and the report of the amount sold, which latter fixes the amount of the fee to be paid, because the party selling the goods is outside of the State and cannot be reached by legal process. Inasmuch as the license fees paid create the fund set apart by the State for the analysis of fertilizers, in order that the purchasers of the same may be protected from fraud, farmers who buy goods, upon which no license fee has been paid, stand in their own light, and, in a measure at least, defeat the provision made for their own protection.

A comparison of the amount of fertilizers sold in the State during the year with the amount of license fees paid, shows that the average cost of the license per ton is about nine cents.

The original purpose of the Act providing for the payment of a license fee upon the fertilizers sold in the State was to provide a fund to meet the expenses of securing and analyzing samples, as nearly as possible, of all the goods sold, and otherwise enforcing the provisions of the law; and as the efficiency of the work depends on the means placed with the Department for this purpose, I would earnestly recommend that the General Assembly appropriate for this object an amount corresponding to the full amount of the fees collected and paid into the State Treasury.

VETERINARY DIVISION.

The work of the Veterinary Bureau, including the operations of the State Livestock Sanitary Board during the year, possessed unusual importance and was carried forward with the same promptness and activity that has characterized the operation of the Bureau since its creation. In my last report reference was made to the outbreak, in the State, of Aphthous Fever, commonly known as foot and mouth disease, which occurred in the month of November, 1908. The disease spread with the rapidity common to all diseases of a highly infectious nature, and before it was gotten under complete control it extended into fifteen counties. The assistance of the Bureau of Animal Husbandry of the National Department of Agriculture was invoked and promptly secured. A large number of veterinarians engaged in active practice in the State were called into service, and a vigorous crusade against the disease was inaugurated which resulted in its extermination in the incredibly short period of ten weeks.

The promptness with which the veterinarians of the State responded to the call, some of whom dropped for the time being a practice that paid them much more than the State, with the means at hand available for the purpose, could pay, is worthy of note and shows a spirit of patriotism rarely exhibited by any class of citizens.

The prevalence of rabies, which has been unusual during the last few years, and especially during the year 1909, has called for strenuous action on the part of the Veterinary Bureau. Outbreaks of this disease occurred in the counties of Adams, Allegheny, Armstrong, Beaver, Bedford, Berks, Blair, Bradford, Bucks, Cambria, Chester, Columbia, Crawford, Cumberland, Dauphin, Delaware, Erie, Fayette, Greene, Indiana, Lackawanna, Lancaster, Luzerne, Lawrence, Mercer, McKean, Monroe, Montgomery, Philadelphia, Pike, Somerset, Sullivan, Susquehanna, Washington, Westmoreland, Wyoming and York.

It is unfortunate that there should exist in the minds of so many people, some of whom belong to the medical profession, doubts concerning the existence of this disease and the means by which it is transmitted from one animal to another and from the lower animals to the human species. This skepticism is one of the principal hindrances to the extermination of the disease. It sometimes leads to indifference, on the part of local officials, and failure to carry out the provisions of the law relating to the establishment and maintenance of quarantines by the State Livestock Sanitary Board.

I regard this matter of so much importance as to suggest to the General Assembly the possibility and propriety of inaugurating a campaign of education upon this subject by the appointment of a Commission to inquire into and disseminate information concerning the origin, nature and characteristics of the disease, together with its prevalence in this and other countries, and such information as may be obtained relating to methods to be employed for its eradication.

It is needless that I shall refer further to the work of the Veterinary Bureau in detail. The full report of the State Veterinarian, who is Chief of the Bureau, and Executive Officer of the Livestock Sanitary Board, is forwarded herewith and will be published in full with this Annual Department Report, and what is here said is only intended to direct attention to this full report.

I cannot, however, close what I have to say concerning the work of this Division without making some reference to the irreparable loss the Bureau has suffered in the death of Dr. Leonard Pearson, which occurred Sept. 20th, 1909. No public officer was ever more devoted to duty or more thoroughly imbued with the importance of his work than this broad-minded, thoroughly equipped scientific man. His devotion to his profession was unsurpassed and all his plans for life-work embraced the good of his fellows and the Commonwealth. In his death this Department has suffered a misfortune from which it will not soon recover and the State sustains a loss that cannot be estimated.

AGRICULTURAL ORGANIZATIONS OF THE STATE.

STATE BOARD OF AGRICULTURE.

The oldest and most influential agricultural organization in the State is the State Board of Agriculture, composed of certain State officials, one member from each county in the State and three persons appointed by the Governor. This Board is well organized, having consulting specialists on nearly all scientific subjects pertaining to agriculture, such as Botanist, Pomologist, Chemist, Veterinarian, Mineralogist, Sanitarian, Microscopist, Entomologist, Ornithologist, Meteorologist, Apiarist, Geologist and on Forestry and Feeding Stuffs. Besides these, it has standing committees on Legislation, Cereals and Cereal Crops, Roads and Road Laws, Fruit and Fruit Culture, Dairy and Dairy Products, Fertilizer, Wool and Textile Fibres, Livestock and Poultry.

These specialists and committees make reports at the annual meetings, held at the Capitol in January of each year, on the various subjects they are appointed by the Board to investigate.

This brings together a fund of valuable information on the various practical and scientific subjects of interest to the farmer, which frequently results in instruction being given the Legislative Committee to acquaint the General Assembly with the legislation the former desires. The reports of these committees also furnish timely information in regard to agricultural conditions throughout the State, so that the journal of the Board, issued as a bulletin of this Department, has become one of the most valuable documents sent out by any of the Departments of the State Government.

This Board is created by Act of Assembly, approved the 8th day of

ditions that should attend the production of milk, so that the health of the public shall not be adversely affected. The important work done and the great good that is being accomplished by this organization would no doubt be enhanced if the State should be represented at these meetings by the Health Department, such representatives to participate in the discussions and to act as advisory members of the body.

The dairy question in all its phases is discussed at these meetings and the very best dairymen of this State, as well as from other states, men who have made this business a success, are usually present to discuss the special department of dairy work they are doing.

The reports of these meetings are printed in the Annual Report of this Department and they form a very important part of our "Agricultural Year Book" on account of the value of these reports to the dairymen of the State, and the assistance derived from them in improving general sanitary conditions.

Prompted by these considerations I asked the General Assembly of 1909 to appropriate to this Department \$1,000.00 for two years to aid in defraying the expenses of this Association, which was granted, and having seen the good that was accomplished I would respectfully recommend that this amount be doubled for the years ending June 1, 1912 and 1913.

STATE LIVESTOCK BREEDERS' ASSOCIATION.

Reference has already been made to the fact that this State does not produce anything like the number of meat producing animals necessary to meet the wants of our people. The same is true of horses and mules. Pennsylvania has for a number of years furnished an important market for these animals brought from other states. With the rapid development of our mining interests, particularly in the western and southwestern portions of the State, the demand for horses and mules has greatly increased. Large numbers of heavy draft horses are imported every year from Illinois, Iowa and other states of the Middle West, while from West Virginia and Kentucky we have been getting a large portion of the saddle and driving horses we need. Hundreds of mules, also, are brought into Pennsylvania every year from Kentucky and Missouri. Hogs and cattle are brought to the markets of this State from the Middle West and from the great stock ranches west of the Missouri River. Hundreds of carloads of dressed meats and animal food products are imported from Chicago and Kansas City.

This immense importation of livestock and animal food products, and the high prices they command within the last few years, impressed our people with the importance of giving more attention to the subject of livestock raising at home. This Department has issued several bulletins, prepared by expert stockmen, giving information along this line. The subjects of Horse, Swine and Sheep Breeding have already been considered and a bulletin giving expert information on the subject of Cattle Raising will be ready for the press in a short time.

The general interest taken in recent years by the farmers of the State in livestock production led, several years ago, to the organization of the State Livestock Breeders' Association. At its meetings, questions of breeds and breeding, feeds and feeding, sheltering, general care, etc., are discussed by men known to have made a success

of the business and the papers read and addresses delivered are published and distributed among the farmers and stock breeders of the State.

The work the Association is doing is regarded with so much favor by this Department, and the good that is being accomplished by it is so apparent, that the attention of the last General Assembly was called to it, and an appropriation of \$500.00 a year, for two years ending June 1, 1911, was made to the Department for aiding the Association in its work.

The importance of this work is increasing with the increase of our population. Hundreds of acres of land within the State, from which the timber has in recent years been taken, are lying idle. Much of this land, with improvements that can be made at comparatively little cost, can be made to produce excellent pasture as well as grain and forage crops. The imperative necessity of raising more live stock in our own State, if we would relieve our people from paying the exorbitant prices that imported meats command, is upon us and, recognizing the important part the State Livestock Breeders' Association is taking in bringing about the conditions so desirable, I would urgently recommend that this appropriation be largely increased by the next General Assembly.

THE STATE HORTICULTURAL ASSOCIATION.

With the decrease in the consumption of meats, the consumption of fruits, especially apples and peaches, has enormously increased, and in creating conditions necessary to supply this demand the State Horticultural Association has been, in co-operation with this Department, as well as with the local Fruit Growers Associations, carrying on a movement to teach the farmers of Pennsylvania the advantages of fruit growing, especially upon soils of the State adapted to this industry and in localities where there is a good fruit market. Our home markets are unsurpassed by the markets of any other section, and our soil and climatic conditions are such as to give a delicacy of flavor to our fruits that is not equalled by the fruits produced in any other state of the Union.

These markets will consume many times more fruit at reasonable prices than they now consume; and with the natural fruit soils and the markets for fruit that we have, we heartily commend the good work the State Horticultural Association is doing.

In recognition of the value of this work, the last General Assembly appropriated \$1,000.00 to aid the Association for two years, and be-

Station, to show the effects of the various elements that go into the composition of fertilizers in all their ramifications. These results have been utilized by all the experiment stations in this country and in many foreign countries. During 1909 these results were published, making an addition to agricultural information unequalled by any other experiment station of the country.

Of equal value is Farmers' Bulletin No. 346, issued by the United States Department of Agriculture and written by Dr. H. P. Armsby, whose connection with the Station covers almost the entire period of its existence, on the "Computation of Rations For Farm Animals By The Use Of Energy Values," for which the experimental work was done at the Pennsylvania State College. The subjects, discussed scientifically, but stated in such a way that the farmer can understand them, are Components of the Animal Body, Components of Feeding Stuffs, The Animal Body as a Machine, Food Requirements, for Maintenance, for Growth, for Fattening, for Milk Production, and for Work, and, finally, the Computation of these Rations. From these and many other publications of work done by the College and Experiment Station along scientific and practical agricultural lines, in Dairying, Horticulture, Animal Husbandry, Poultry and General Farming, we get some idea of the great work this Institution is doing for the advancement of agriculture and for making this industry more efficient in all of its various branches.

It is essential that the farmer should have this information so that he may maintain the fertility of his soil by feeding its products, and thus get the best results with the least waste. Such is the information that comes from our Agricultural College, which during the last few years, has reached a position at the very head of institutions of its kind, and I trust that the appreciation of this institution by our people and the General Assembly of the State will keep pace with the marvelous progress it is making, so that the appropriations needed to augment and continue its usefulness may be promptly provided.

A STATE FAIR.

It is not necessary to give a history of the old State Fair Association, except to say that before any of the organizations, the splendid work of which we have been enumerating, were in existence or even this Department, with all its Divisions, was created, there was in Pennsylvania a State Fair Association. And when it is said that this Association, with a paltry appropriation of \$2,000.00 annually, for premiums for agricultural exhibits, was the agency that set in motion the many Agricultural Fairs held every year in every section of the State, distributing thousands of dollars in premiums, and that some of these Societies have become so wealthy from entry fees and gate receipts that they do not know how to spend their money, there is no exaggeration, but a simple statement of facts. When such results can be achieved locally by County Associations, what should be the possibilities of a great State Exhibit, drawn from the best exhibits made at all the county or local fairs?

I have, in several former Reports, referred to the importance of a State Fair, giving my reasons for believing that the agricultural interests of the Commonwealth would be greatly advanced by its establishment and maintenance and, without repeating any of these

reasons, I would again respectfully call the attention of the General Assembly of the State to its importance and urge the necessary legislation to provide for its organization and support.

In concluding this Report, I desire, again, to tender to your Excellency my sincere thanks for the hearty support you have uniformly given me in carrying forward the work of the Department, and to express my appreciation of the good work done by the agricultural and public press which has in so many ways proved helpful to me personally as well as to the Department.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "A. B. Britchfield".

Secretary of Agriculture.

**FIFTEENTH ANNUAL REPORT OF THE DIVISION OF
FARMERS' INSTITUTES FOR THE SEASON OF
1908-9.**

Harrisburg, Pa., January 1, 1910.

To the Hon. N. B. Critchfield, Secretary of Agriculture:

Sir: I have the honor herewith to present the Fifteenth Annual Report of the Division of Farmers' Institutes.

CROP CONDITIONS.

It may be fairly stated that the farmers of Pennsylvania have (when everything is considered) experienced a highly successful year in their various lines of farm operations. Although the season was marked with some exceedingly adverse conditions, amongst which was a long and continued drouth, beginning early in month of June, and, with the exception of a few localities, holding out until the latter part of September, thus seriously cutting short all hoed crops, particularly corn, potatoes and such vegetables as are grown by market gardeners. The adverse weather conditions, however, served in a marked manner to demonstrate the importance of thorough cultivation as a means of conserving moisture. As the drouth continued, we received many letters asking if it was proper to cultivate corn and potatoes in a dry time. Letters of this character became so general that we deemed it expedient to publish in the secular and agricultural papers a brief letter advising the farmers to keep up a continuous cultivation in order to conserve moisture from the subsoil. Amongst many letters received, the following will give results procured by this most approved practice, also the signal failure where cultivation was abandoned:

"Dear Sir:

"I am having a discussion with my neighbor about cultivating my corn ground this dry weather. He claims better stay out of field; too dry to work. I am cultivating my field continuously. Will you please advise us as to the proper course to pursue."

The answer was to keep up constant cultivation, requesting a report of results in yield of corn in the two adjoining fields. The result as reported was, the field *slightly* cultivated yielded 10 bushels per acre. The field constantly cultivated yielded 50 bushels per acre. These fields were located on either side of the public road and were practically of the same texture of soil, so that the one factor entering into the increased *production* of the intensely cultivated field over the slightly cultivated field, stands as a strong proof of the importance of thorough cultivation in the successful growing of all farm and garden crops. I am thoroughly convinced that if the farmers' would uniformly practice a system of constant and thorough cultivation, the average yield per acre would be increased *on all crops* not less than 30 per cent.

INSTITUTE DEVELOPMENT.

In our last Annual Report, a pretty thorough outline was given of the subject matter developed at our Farmers' Institutes throughout that year, so that we deem it unnecessary to enter fully into detail in this regard, further, than to say, that in all lines of farm operation, embracing as it does soil improvement, with the best methods to be adopted in its accomplishment, the means employed, thorough cultivation, the growing of vegetables and legumes, careful and economic handling and applying of barnyard manures, etc., has been fully developed and generally adopted by the progressive farmers of the State, largely through the influence of the Farmers' Institutes.

SUMMARY.

The attendance at institutes was all that could be expected; in fact in many places halls and churches could not accommodate the people. It might be interesting to state that we held in all, 982 sessions, with a total attendance of 156,652, giving us an average per session of 156 persons. In addition to the regular institutes, was held our Annual Normal Farmers' Institute. This meeting has come to be looked upon as the barometer by which our work throughout the State may be judged. At this meeting, the program, which will appear in another portion of our report, there was held nine sessions having a total attendance of 1800. This attendance was represented by delegates from every county of the State, each delegate contributing to this meeting his best thought and practice in agriculture, the proceedings of which are published in bulletin form and distributed throughout the State.

Stronger proof could not be presented of the manner in which the work is received in the various counties, than the statement that there were held in addition to the regular scheduled institutes, 30 special Institutes organized by local people for which the Department supplied lecturers, total attendance at which was 29,160.

This report would be incomplete without reference to our system of Movable Agricultural Schools so recently organized. I may say, that in certain portions of the State where special lines are followed, such as Dairying, Horticulture and Poultry, the Movable School is admirably adapted to meet requirements of such conditions, since they afford opportunity to develop and demonstrate approved methods of Feeding Animals, Sanitary Manner of Handling Milk and all that relates to a higher order of Dairy Husbandry. These schools have

ANNUAL REPORT OF THE

Off. Doc.

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1908-1909.

Place.	Date.	Attendance by Sessions.													
		Speaker present.			Attendance.			H. Y. committee.			Total.				
Days of Institute.		Number of sessions.		Average.		Total.		Speaker present.		Attendance.		H. Y. committee.		Total.	
W. Oxford, -----	Jan. 18-19, -----	5	5	40	40	135	135	5	5	40	40	135	135	5	5
W. Berlin, -----	Jan. 20-21, -----	5	5	50	50	175	175	5	5	50	50	175	175	5	5
W. Andoverville, -----	Jan. 21-22, -----	5	5	40	40	120	120	5	5	40	40	120	120	5	5
W. Ley, -----	Dec. 22-23, -----	5	5	40	40	120	120	5	5	40	40	120	120	5	5
W. Terrell, -----	Feb. 18-19, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Uhlerville, -----	Feb. 19-20, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Ohio, -----	Feb. 19-20, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Ia., -----	Feb. 19-20, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Kland, -----	Feb. 28-29, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Okotown, -----	Jan. 4-5, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. or Mill U. P. Church, -----	Jan. 6-7, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. record M. E. Church, -----	Jan. 8-9, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Jarrow, -----	Dec. 16-17, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Lerton, -----	Dec. 18-19, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. t's Church, -----	Dec. 21-22, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. retnary, -----	Feb. 24, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. isertown, -----	Feb. 25-26, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. derryville, -----	March 1-2, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. canaville, -----	March 3-4, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Ilwood, -----	Feb. 10-11, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Jd Eagle, -----	Feb. 12-13, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Albany, -----	Feb. 15-16, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. iter, -----	Nov. 27-28, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Rayesville, -----	Nov. 29-Dec. 1, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. ne Hill, -----	Dec. 2-3, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. eeville, -----	Dec. 4-5, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. amatedville, -----	Feb. 1-2, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. Anderville, -----	Feb. 3-4, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5
W. bladetown, -----	Feb. 6-7, -----	5	5	50	50	150	150	5	5	50	50	150	150	5	5

Upper Rock,	Jan. 18-19,	150, 800, 75, 220, 900,	4	425	2,175
Drew,	Jan. 20-21,	65, 800, 35, 125, 275,	4	160	800
ton,	Jan. 22-23,	125, 250, 800, 180, 300,	4	821	1,016
town,	Jan. 11-12,	86, 160, 140, 170, 160,	4	866	4,580
Wom	Jan. 13-14,	110, 200, 65, 190, 220,	3	144	720
lling Run,	Jan. 15-16,	70, 180, 220, 250, 250,	3	168	1,075
rville	March 1,	25, 50, 75, 90, 90,	3	150	2,880
Valley	March 2,	45, 45, 45, 45, 45,	3	100	100
t Creek,	March 3,	19, 13, 40, 30, 30,	3	17	122
man,	Jan. 16,	18, 81, 10, 25, 10,	4	49	300
thery,	Jan. 18-19,	6, 25, 60, 25, 30, 150,	4	18	36
nsburg,	Feb. 22-23,	240, 370, 200, 220, 220,	2	266	1,520
Grove Mills,	Feb. 24-25,	65, 180, 95, 150, 230,	2	146	720
nstown,	Feb. 26-27,	85, 220, 150, 275, 450,	2	312	1,680
onville,	Jan. 13-14,	70, 250, 250, 160, 250,	3	1	970
rd,	Jan. 15-16,	200, 320, 150, 300,	3	244	975
arville,	Feb. 22-23,	900, 350, 140, 240, 100,	4	206	1,080
rs,	March 1-2,	22, 22, 7, 60, 140, 200,	4	102	407
Run,	Jan. 22-23,	200, 230, 300, 300, 975,	2	5	945
raburg,	Feb. 22-23,	110, 225, 100, 130, 200,	4	158	705
ourg	Feb. 24-25,	110, 300, 65, 140, 400,	4	4	1,015
nsburg,	Feb. 26-27,	20, 165, 40, 100, 300,	4	301	1,506
ield,	Jan. 4-5,	118, 180, 98, 110, 185,	3	126	625
lville,	Jan. 6-7,	110, 225, 115, 220, 300,	3	138	691
dland,	Jan. 8-9,	110, 190, 195, 215, 300,	3	2	900
ntona,	Jan. 10-11,	110, 185, 162, 260,	4	188	940
sdale,	Jan. 11-12,	27, 25, 125, 40, 124,	4	209	631
lth,	Jan. 13-14,	15, 42, 165, 28, 110, 220,	4	68	341
nsburg,	Jan. 11-16,	250, 160, 200, 300, 335,	2	97	630
ville,	March 1-2,	250, 200, 160, 240, 190,	4	162	2,490
sville,	March 3-4,	180, 365, 325, 125, 350,	3	344	1,720
erville,	Feb. 10-13,	86, 66, 105, 180, 220,	3	126	830
dville,	Dec. 14-15,	50, 59, 90, 120, 78, 86,	2	78	235
le, Spring,	Dec. 16-17,	150, 240, 60, 230, 50,	4	86	849
estown,	Dec. 18-19,	6, 115, 50, 100, 175,	4	102	3,454
Holytown,	Aug. 18,	26, 75, 80, 40, 45,	4	101	510
Holy Springs,	Dec. 21-22,	85, 125, 30, 45, 130,	4	233	275
amora,	Jan. 4-5,	65, 285, 60, 100, 250,	4	73	881
rysburg,	March 20,	50, 100, 40, 125, 200,	2	162	760
nmetown,	Jan. 18-19,	60, 60, 30, 125, 200,	4	500	1,625
le,	Jan. 20-21,	1, 1, 1, 1, 1, 1, 1, 1, 1,	9	103	515
cordville,	Jan. 22,	65, 70, 25, 75, 160,	3	104	415
town Square,	Feb. 15-16,	51, 85, 50, 60, 100,	3	80	1,170
Manys,	Feb. 17-18,	51, 85, 50, 60, 100,	3	69	486
isela,			1	69	841

ANNUAL REPORT OF THE

Off. Doc.

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1908-1909—Continued.

Place.	Date.	Attendance by Sessions.		Speakers Present.	Attendance.		
		Days of Institute.	Number of sessions.			Total.	Average.
Attendance by Sessions.							
ard,	Feb. 12.	2	5	103	900	115	226
1 Village,	Feb. 3.	1	3	180	900	300	300
e,	Feb. 8-11.	4	11	105	150	115	140
har,	Feb. 1-2.	5	70	100	100	125	80
metropolis,	Feb. 8-4.	2	6	45	260	70	300
neets,	Feb. 10-11.	2	5	15	100	200	75
rloria,	Feb. 12-13.	2	5	70	37	300	55
metabur,	Nov. 30.	1	2	44	45	250	150
y Run,	Dec. 1-2.	2	5	135	85	140	70
Thomas,	Dec. 3-4.	2	5	40	160	22	400
ron,	Dec. 5.	1	8	40	40	50	100
Connellsburg,	Dec. 11-12.	5	5	110	270	65	180
stonown,	Dec. 14-15.	2	5	90	275	80	250
ynesburg,	Dec. 12-3.	3	7	60	75	75	110
town,	Dec. 3-4.	8	6	150	100	70	160
rior's Mark,	March 1-2.	2	5	90	120	85	100
xandria,	March 3-4.	2	5	22	80	95	140
rleyburg,	March 5-6.	4	5	22	50	100	200
lerville,	Nov. 27-28.	2	5	40	30	75	65
town,	Nov. 30-Dec. 1.	2	5	68	80	275	160
let,	Dec. 3-4.	3	8	125	120	85	250
rs,	Dec. 4-5.	3	4	40	60	160	110
reburg,	Feb. 17-18.	5	9	90	100	150	250
radie,	Feb. 19-30.	5	5	50	100	125	150
onpointown,	Feb. 1-2.	2	5	150	140	250	200
enna,	Feb. 3-4.	2	5	65	50	25	45
ton,	Nov. 28-30.	3	6	80	25	75	60
d Mount,	Nov. 30-Dec. 1.	2	5	81	60	172	120
rtile,	Dec. 1-2.	2	5	9	10	175	210
nptville,	Dec. 2-3.	5	24	40	140	100	225

ANNUAL REPORT OF THE

Off. Doc.

PENNSYLVANIA FARMERS' INSTITUTES—SEASON OF 1908-1909—Continued.

Place.	Date.	Attendance by Sessions.		Speaker present.	Attendance.	By counties.	Off. Doc.
		Total.	Average.				
upack, -----	Dec. 21-22, -----	5	50	30, 18,	75	25, 75	213
entown, -----	Dec. 22-24, -----	2	50	175, 300,	40, 20	4	117
seen, -----	Feb. 22, -----	1	50	30, 115,	80	3	32
eden Valley, -----	Feb. 22-24, -----	2	50	75, 100,	85	3	50
ulete, -----	Feb. 25-26, -----	2	50	60, 60,	140, 75	3	30
errove, -----	March 1-2, -----	2	50	45, 60,	120, 100,	1	35
mans, -----	March 8-9, -----	2	50	300, 180,	300, 400	2	206
Pleasant Mills, -----	March 11-12-13, -----	3	50	110, 220,	240, 180,	2	167
ingrove, -----	Feb. 15-16, -----	2	50	110, 240,	120, 130,	4	165
meret, -----	Jan. 18-19-20, -----	3	50	500, 350,	220, 280	3	265
ckwood, -----	Jan. 21-22, -----	2	50	140, 90,	210, 280	2	222
ney Valley, -----	Dec. 19-20, -----	5	50	47, 98,	160, 100,	1	98
burn Centre, -----	Jan. 4-5, -----	2	50	75, 150,	275, 300	4	186
wton, -----	Jan. 6-7, -----	2	50	150, 150,	320, 320	4	148
urford, -----	Jan. 8-9, -----	2	50	175, 225,	220, 250	4	190
ntrose, -----	Jan. 11, -----	1	50	80, 125,	250, 250	4	105
nsboro, -----	Jan. 15-16, -----	2	50	750, 450,	500, 500	3	565
nkfield, -----	Jan. 18-19, -----	2	50	250, 250,	320, 320	2	325
gs, -----	Jan. 20, -----	1	50	80, 140,	280, 320	1	108
ole, -----	Jan. 21-22, -----	5	50	75, 175,	160, 140	4	460
amey Cor., -----	Jan. 22-23, -----	2	50	70, 65,	170, 125	4	90
nfield, -----	Feb. 17-18, -----	5	50	40, 60,	220, 170	3	188
relton, -----	Feb. 19-20, -----	2	50	100,	125, 180	2	18
edtown, -----	Feb. 22-23, -----	3	50	60, 60,	150, 180	1	146
lk, -----	Feb. 25-27, -----	5	50	100,	200, 150,	1	119
humbur, -----	Feb. 4-5, -----	5	50	108, 117,	186, 150,	4	163
ttville, -----	Feb. 6-7, -----	1	50	106, 127,	146, 127	3	140
rran, -----	Feb. 8-9, -----	5	50	96, 106,	146, 146	4	127
erry Hill, -----	Dec. 14-15, -----	5	50	20, 170,	100, 200	4	97
key Foot, -----	Dec. 16-17, -----	2	50	20, 170,	100, 180	4	105
st Middletown, -----	Dec. 18-19, -----	5	50	50,	200, 200	4	177
							1,565
							1,565

**MEETING OF THE FARMERS' ANNUAL NORMAL
INSTITUTE.**

PROGRAM.

First Session convenes Tuesday Afternoon, May 25, 1909.

MR. G. F. BARNES, Rossville, Pa., Chairman.

Call to order 1.30.

Addressess of Welcome, by Mayor Jacob S. Weaver, York, Pa.

Judge Nevin Warner, York, Pa.

Response, by Hon. A. L. Martin, Director of Institutes, Harrisburg, Pa.

1. "MAINTENANCE OF SOIL FERTILITY."

Prof. Franklin Menges, York, Pa.

2 "SOIL MOISTURE."

Prof. Chas. F. Shaw, State College, Pa.

Tuesday Evening, May 25, 1909.

MR. E. J. DURNALL, Swarthmore, Pa., Chairman.

Call to order 7.30.

1. "COMMERCIAL ORCHARDING."

Dr. J. H. Funk, Boyertown, Pa.

2. "MISCIBLE OILS."

Prof. Chas. L. Penny, State College, Pa.

3. "THE MAN AND WOMAN CROP."

H. W. Collingwood, Editor Rural New Yorker, New York City.

Wednesday Morning, May 26, 1909.

MR. HORACE SEAMANS, Factoryville, Pa., Chairman.

Wednesday Afternoon, May 26, 1909.

MR. JASON SEXTON, North Wales, Pa., Chairman.

Call to order 1.30.

1. "POULTRY KEEPING ON THE FARM."

H. W. Jackson, Cambridge, Ohio, R. F. D.

2. "POULTRY LIGHT FOR THOSE WHO SIT IN DARKNESS."

Chas. T. Cornman, Carlisle, Pa.

3. "POULTRY HOUSE CONSTRUCTION." (Illustrated.)

W. Theo. Wittman, Allentown, Pa.

Wednesday Evening, May 26, 1909.

MR. J. ALDUS HERR, Lancaster, Pa., R. F. D., Chairman.

Call to order 7.30.

1. "PROFITABLE SHEEP FARMING."

Joseph E. Wing, Mechanicsburg, Ohio.

2. "STARTING A FLOCK OF SHEEP."

J. S. Burns, Imperial, Pa., R. F. D. No. 1.

3. "BREEDING BEEF CATTLE."

E. S. Bayard, Editor National Stockman
and Farmer, Pittsburg, Penna.

Thursday Morning, May 27, 1909.

HON. H. G. McGOWAN, Geigers Mills, Pa., Chairman.

Call to order 9.00.

1. "THE INDIGESTIBLE PART OF THE RATION FOR A DAIRY COW."

Prof. Wells W. Cooke, U. S. Dept. of Agriculture, Washington, D. C.

2. "HORSE BREEDING FOR THE PENNSYLVANIA FARMER."

Prof. T. I. MAIRS, State College, Pa.

3. "THE DRAFT FROM THE VIEW POINT OF THE PENNSYLVANIA FARMER."

Prof. Carl W. Gay, In charge of Horse Breeding, State Livestock Sanitary Board, Philadelphia, Pa.

Thursday Afternoon, May 27, 1909.

Call to order 1.30.

Mr. E. B. DORSETT, Mansfield, Pa., Chairman.

THIS SESSION WILL BE DEVOTED TO GENERAL DISCUSSION FOR THE DEVELOPMENT OF QUESTIONS RELATING TO THE INSTITUTE WORK THROUGHOUT THE STATE.

Note.—In order to give the greater number of persons an opportunity to be heard, five minutes is allotted to each speaker.

Thursday Evening, May 27, 1909.

MR. J. C. WELLER, Rockwood, Pa., Chairman.

Call to order 7.30.

1. "THE SPLIT ROAD DRAG AND ITS USE FOR DIRT ROADS IN PENNSYLVANIA." D. Ward King, Maitland, Mo.
 2. "SOIL IMPROVEMENT FOR MARKET GARDENING AND SMALL FRUIT CULTURE." Prof. R. L. Watts, State College, Pa.
 3. "MARKET GARDENING AND SMALL FRUIT GROWING FOR A PROFIT." Hon. R. F. Schwarz, Analomink, Pa.
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Friday Morning, May 28, 1909.

MR. J. P. YOUNG, Marion, Pa., Chairman.

Call to order 9.00.

1. "CORN IMPROVEMENT BY SELECTION, BREEDING AND TESTING." Prof. Frank D. Gardner, State College, Pa.
2. "TWENTY YEARS' EXPERIENCE IN CORN GROWING AND BREEDING." L. W. Lighty, East Berlin, Pa.
3. "ORCHARD AND GARDEN INSECTS; HOW TO CONTROL THEM." Wm. H. Wolff, West Chester, Pa.

Closing Remarks and Adjournment.

**LIST OF COUNTY INSTITUTE MANAGERS
FOR SEASON OF 1908-9.**

County.	Name and Address of Chairmen.
Adams,	A. I. Weidner, Arendtsville.
Allegheny,	J. S. Burns, Imperial, Pa., R. F. D. No. 1.
Armstrong,	S. S. Blyholder, Neale.
Beaver,	A. L. McKibben, New Sheffield.
Bedford,	David W. Lee, Bedford.
Berks,	Howard G. McGowan, Geiger's Mills.
Blair,	Howard Cox, Bellwood.
Bradford,	Edwin Platt, Wysox, R. F. D.
Bucks,	Watson T. Davis, Ivyland.
Butler,	N. F. Bartley, Euclid.
Cambria,	H. M. Gooderham, Patton, R. F. D. No. 1.
Cameron,	W. H. Howard, Emporium.
Carbon,	R. A. Eroh, Weatherly.
Center,	John A. Woodward, Howard.
Chester,	Dr. M. E. Conard, Westgrove.
Clarion,	S. X. McClellan, Knox.
Clearfield,	E. M. Davis, Grampian.
Clinton,	Joel A. Herr, Millhall, R. F. D.
Columbia,	A. P. Young, Millville.
Crawford,	J. F. Seavy, Saegerstown.
Cumberland,	T. J. Ferguson, Mechanicsburg.
Dauphin,	S. F. Barber, Harrisburg.
Delaware,	E. J. Durnall, Swarthmore.
Elk,	J. B. Werner, St. Marys.
Erie,	Archie Billings, Edinboro.
Fayette,	Sylvester Duff, Smock.
Forest,	C. A. Randall, Tionesta.
Franklin,	J. P. Young, Marion.
Fulton,	J. L. Patterson, McConnellsburg.
Greene,	J. W. Stewart, Jefferson.
Huntingdon,	G. G. Hutchison, Warrior's Mark.
Indiana,	S. M. McHenry, Indiana.
Jefferson,	Peter B. Cowan, Brookville.
Juniata,	Matthew Rodgers, Mexico.
Lackawanna,	Horace Seamans, Factoryville.
Lancaster,	J. Aldus Herr, Lancaster, R. F. D.
Lawrence,	Samuel McCreary, Volant, R. F. D.
Lebanon,	Edwin Shuey, Lickdale.
Lehigh,	P. S. Fenstermaker, Allentown.
Luzerne,	J. E. Hildebrant, Dallas, R. F. D.
Lycoming,	A. J. Kahler, Hughesville.

County.	Name and Address of Chairmen.
McKean,	Dr. Geo. A. Dick, Kane.
Mercer,	W. C. Black, Mercer.
Mifflin,	M. M. Naginey, Milroy.
Monroe,	Randall Bisbing, East Stroudsburg.
Montgomery,	Jason Sexton, North Wales.
Montour,	C. A. Wagner, Ottawa.
Northampton,	C. S. Messinger, Tatamy.
Northumberland,	I. A. Eschbach, Milton, R. F. D. No. 1.
Philadelphia,	J. B. Kirkbride, Bustleton.
Perry,	A. T. Holman, Millerstown.
Pike,	B. F. Killam, Paupack.
Potter,	Horace H. Hall, Ellisburg.
Schuylkill,	W. H. Stout, Pinegrov.
Snyder,	Chas. Miller, Salem.
Somerset,	J. C. Weller, Rockwood, R. F. D. No. 2.
Sullivan,	E. R. Warburton, Campbellsville.
Susquehanna,	F. A. Davies, Montrose.
Tioga,	E. B. Dorsett, Mansfield.
Union,	J. Newton Glover, Vicksburg.
Venango,	W. A. Crawford, Cooperstown.
Warren,	Geo. A. Woodside, Sugargrove. •
Washington,	D. S. Taylor, Burgettstown, R. F. D. No. 3.
Wayne,	W. E. Perham, Pleasant Mt., R. F. D. No. 3.
Westmoreland,	M. P. Shoemaker, Greensburg.
Wyoming,	D. A. Knuppenburg, Lake Carey.
York,	G. F. Barnes, Rossville.

LIST OF INSTITUTE LECTURERS FOR SEASON OF 1908-9.

Agee, Prof. Alva, State College, Pa.
 Allen, Mrs. Mollie MacCloughry, Oswego, N. Y., R. F. D.
 Anderson, H. M., New Park, Pa.
 Barclay, Richard D., No. 125 South Front street, Philadelphia, Pa.
 Baker, Miss A. C., Chadds Ford, Pa.
 Black, Wm. C., Mercer, Pa.
 Bond, M. S., Danville, Pa.
 Brodhead, Mrs. C. W., Montrose, Pa.
 Brodhead, C. W., Montrose, Pa.
 Bruckart, J. W., Lititz, Pa.
 Campbell, J. T., Hartstown, Pa.
 Card, Fred W., Sylvania, Pa.
 Clark, M. N., Claridge, Pa.
 Conard, Dr. M. E., Westgrove, Pa.
 Cooke, Prof. Wells W., U. S. Dept. of Agriculture, Washington, D. C.
 Cox, John W., New Wilmington, Pa.

Callahan, Ellery E., Wellsboro, Pa.
Drake, W. M. C., Volant, Pa.
Detrich, Dr. J. D., No. 438 Adams Ave., Scranton, Pa.
Easchbach, I. A., Milton, Pa., R. F. D. No. 1.
Fassett, F. H., Meshoppen, Pa.
Funk, Dr. J. H., Boyertown, Pa.
Gooderham, H. M., Patton, Pa., R. F. D. No. 1.
Hall, Horace H., Ellisburg, R. F. D., Pa.
Herr, Prof. John D., Division of Economic Zoologist, Harrisburg, Pa.
Hoover, E. S., Lancaster, Pa.
Hull, Geo. E., Transfer, Pa., R. F. D.
Jackson, Homer W., Cambridge, Ohio, R. F. D. No. 1.
Kahler, A. J., Hugheville, Pa.
Klein, Dr. Louis A., Deputy State Veterinarian, Harrisburg, Pa.
Kester, R. P., Grampian, Pa.
Ledy, J. H., Marion Pa.
Lehman, Amos B., Fayetteville, Pa.
Lighty, L. W., East Berlin, Pa.
Mairs, Prof. T. J., State College, Pa.
McCurdy, Clarence C., Hartstown, Pa.
McDowell, M. S., State College, Pa.
Menges, Prof. Franklin, York, Pa.
Moats, H. E., Jamestown, Pa.
Northup, Henry W., Dalton, Pa., R. F. D. No. 1.
Owens, Prof. Wm. G., Lewisburg, Pa.
Peachey, J. H., Belleville, Pa.
Penny, Prof. Chas. L., State College, Pa.
Phillips, T. J., Atglen, Pa.
Phillips, E. L., New Bethlehem, Pa.
Pillsbury, Dr. J. P., State College, Pa.
Posten, B. Monroe, Sheakleyville, Pa.
Rich, Chas. H., Woolrich, Pa.
Ross, A. B., Schellsburg, Pa.
Schwarz, R. F., Analomink, Pa.
Seeds, Robt. S., Birmingham, Pa.
Stephens, A. W., Lewisburg, Pa.
Stewart, Prof. J. P., State College, Pa.
Stout, W. H., Pinegrove, Pa.
Thomas, Miss Sara Phillips, Wayne, R. F. D. No. 1.
Van Norman, Prof. H. E., State College, Pa.
VanNoy, Leon Otice, Troy, Pa., R. F. D. No. 66.
Wagner, F. J., Harrison City, Pa.
Wallace, Mrs. Mary A., New Castle, Pa.
Watts, Prof. R. L., State College, Pa.
Watts, D. H., Kerrmoor, Pa.
Waychoff, G. B., Jefferson, Pa.
Weld, R. J., Sugargrove, Pa.
Wilson, Chas. A., Stewartstown, Pa., R. F. D. No. 4.
Wittman, W. Theo., Allentown, Pa.
Wolff, Wm. H., West Chester, Pa
Wolsieffer, Harry, Buck Hill Falls, Pa.
Woodman, S. Paul, Rushland, Pa.
Zeigler, Mrs. Sarah B. F., Duncannon, Pa.

**THE FOLLOWING IS A LIST OF SPEAKERS AND THEIR
ASSIGNMENTS, ALSO BIOGRAPHICAL SKETCH OF
THEIR LIVES, SEASON OF 1908-9.**

PROF. ALVA AGEE, State College, Centre County, Pa.

Town.	County.	Dates.
Unionville,	Chester,	Jan. 13-14.
Oxford,	Chester,	Jan. 15-16.
Townville,	Crawford,	Mar. 1-2.
Linesville,	Crawford,	Mar. 3-4.
Espyville,	Crawford,	Mar. 5.

**MRS. MOLLIE MacCLAUGHRY ALLEN, Oswego, N. Y., R. F. D.
No. 6.**

New Albany,	Bradford,	Nov. 27-28.
Ulster,	Bradford,	Nov. 31-Dec. 1.
Leraysville,	Bradford,	Dec. 2-3.
Lime Hill,	Bradford,	Dec. 4-5.
Red Lion,	York,	Feb. 5-6.
Manchester,	York,	Feb. 5-6.
Rossville,	York,	Feb. 8-9.
Dillsburg,	York,	Feb. 10-11.
Quarryville,	Lancaster,	Feb. 12-13.
Lampeter,	Lancaster,	Feb. 15-16.
Maytown,	Lancaster,	Feb. 17-18.
Ephrata,	Lancaster,	Feb. 19-20.

H. M. ANDERSON, New Park, York County, Pa.

Pineville,	Bucks,	Feb. 1-2.
Plumsteadville,	Bucks,	Feb. 3-4.
Sellersville,	Bucks,	Feb. 5-6.

MISS A. C. BAKER, Chadds Ford, Delaware County, Pa.

Town.	County.	Dates.
Berrysburg,	Dauphin,	Jan. 4-5.
Liverpool,	Blair,	Jan. 6-7.
Blain,	Perry,	Jan. 8-9.
Jckesburg,	Perry,	Jan. 11.
Jonestown,	Lebanon,	Jan. 12-13.
Schaefferstown,	Lebanon,	Jan. 14-15.
Campbelltown,	Lebanon,	Jan. 16.

WM. C. BLACK, Mercer, Mercer County, Pa.

Dunbar,	Fayette,	Feb. 1-2.
Perryopolis,	Fayette,	Feb. 3-4.
Scottdale,	Westmoreland,	Feb. 5-6.

M. S. BOND, Danville, Montour County, Pa.

Tunkhannock,	Wyoming,	Dec. 14-15.
Lovelton,	Wyoming,	Dec. 16- 17.
Muncy Valley,	Sullivan,	Dec. 18-19.
Montgomery,	Lycoming,	Dec. 21-22.
Huffs Church,	Berks,	Feb. 24.
Virginsville,	Berks,	Feb. 25-26.
Geigertown,	Berks,	Feb. 27.
Amityville,	Berks,	Mar. 1-2.
Millersburg,	Berks,	Mar. 3-4.
Pinegrove,	Schuylkill,	Mar. 5-6.
Pitman,	Schuylkill,	Mar. 8-9.

MR. AND MRS. C. W. BROWNEAD, Montrose, Susquehanna County, Pa.

Richland,	Bucks,	Feb. 8-9.
Ackermanville,	Northhampton,	Feb. 10-11.
Tatamy,	Northhampton,	Feb. 12-13.
Bath,	Northhampton,	Feb. 15-16.

J. W. BRUCKART, Lititz, Lancaster County, Pa.

Auburn Centre, ...	Susquehanna,	Jan. 4-5.
Harford,	Susquehanna,	Jan. 6-7.
Lawton,	Susquehanna,	Jan. 8-9.
Montrose,	Susquehanna,	Jan. 11.
Lehman,	Luzerne,	Jan. 12-13.
White Haven,	Luzerne,	Jan. 14-15.
Bowmanstown,	Carbon,	Jan. 16.
Weatherly,	Carbon,	Jan. 18-19.
Shawnee,	Monroe,	Jan. 20-21.
Brodheadsville,	Monroe,	Jan. 22-23.
Bassardville,	Monroe,	Jan. 25.

J. T. CAMPBELL, Hartstown, Crawford County, Pa.

Will attend all meetings in Part one of the Fourth Section.

FRED. W. CARD, Sylvania, Bradford County, Pa.

Town.	County.	Dates.
Penfield,	Clearfield,	Jan. 4-5.
Troutville,	Clearfield,	Jan. 6-7.
Woodland,	Clearfield,	Jan. 8-9.
Patton,	Cambria,	Jan. 11-12.
Nicktown,	Cambria,	Jan. 13-14.
Wilmore,	Cambria,	Jan. 15-16.
Somerset,	Somerset,	Jan. 18-19-20.
Rockwood,	Somerset,	Jan. 21-22.

M. N. CLARK, Calridge, Westmoreland County, Pa.

Dalton,	Lackawanna,	Nov. 30.
Bald Mount,	Lackawanna,	Dec. 1.
Fleetville,	Lackawanna,	Dec. 2.
Tompkinsville,	Lackawanna,	Dec. 3.
Madisonville,	Lackawanna,	Dec. 4.
Daleville,	Lackawanna,	Dec. 5.
Warrensville,	Lycoming,	Jan. 4-5.
Jersey Shore,	Lycoming,	Jan. 6-7.
Loganton,	Clinton,	Jan. 8-9.

DR. M. E. CONARD, Westgrove, Chester County, Pa.

Will attend all meetings in Part one of the First Section.

PROF. WELLS W. COOKE. U. S. Department of Agriculture,
Washington, D. C.

Dalton,	Lackawanna,	Nov. 30.
Bald Mount,	Lackawanna,	Dec. 1.
Fleetville,	Lackawanna,	Dec. 2.
Tompkinsville,	Lackawanna,	Dec. 3.
Madisonville,	Lackawanna,	Dec. 4.
Daleville,	Lackawanna,	Dec. 5.
Middle Springs,	Cumberland,	Dec. 14-15.
New Kingston,	Cumberland,	Dec. 16.
Hogestown,	Cumberland,	Dec. 17.
Churchtown,	Cumberland,	Dec. 18-19.
Matamoras,	Dauphin,	Dec. 21-22.
Hookstown,	Beaver,	Jan. 4-5.
Four Mile U. P.		
Church,	Beaver,	Jan. 6-7.
Emanuel Church,	Beaver,	Jan. 8-9.

JOHN W. COX, New Wilmington, Lawrence County, Pa.

Town.	County.	Dates.
Grove City,	Mercer,	Mar. 1-2.
West Virginia,	Mercer,	Mar. 3-4.
Hadley,	Mercer,	Mar. 5-6.

ELLERY E. CALLAHAN, Wellsboro, Tioga County, Pa.

Beyers,	Chester,	Mar. 1-2.
Center Point,	Montgomery,	Mar. 3-4.
Schwenksville,	Montgomery,	Mar. 5-6.
Bustleton,	Philadelphia,	Mar. 8-9.

W. M. C. DRAKE, Volant, Lawrence County, Pa.

Waynesburg,	Greene,	Dec. 1-2-3.
Newtown,	Greene,	Dec. 4-5.
Scenery Hill,	Washington,	Dec. 14-15.
Finleyville,	Washington,	Dec. 16-17.
West Middletown,	Washington,	Dec. 18-19.
Union Church,	Allegheny,	Dec. 21-22.

DR. J. D. DETRICH, No. 438 Adams Ave., Scranton, Pa.

Bloomsburg,	Columbia,	Jan. 11-14.
East Smethport,	McKean,	Feb. 5-6.
Erie,	Erie,	Feb. 8-9
Meadville,	Crawford,	Feb. 10-11.

I. A. ESCHBACH, Milton, Pa., R. F. D. No. 1, Northumberland County, Pa.

Middle Springs,	Cumberland,	Dec. 14-15.
New Kingston,	Cumberland,	Dec. 16.
Hogestown,	Cumberland,	Dec. 17.
Churchtown,	Cumberland,	Dec. 18-19.
Matamoras,	Dauphin,	Dec. 21-22.

F. H. FASSETT, Meshoppen, Wyoming County, Pa.

Girard,	Erie,	Feb. 1-2.
Millvillage,	Erie,	Feb. 3.
Columbus,	Warren,	Feb. 4-5.
Lottsville,	Warren,	Feb. 6.
Bellville,	Mifflin,	Feb. 8-9.
Duncansville,	Blair,	Feb. 10-11.
Bellwood,	Blair,	Feb. 12-13.
Bald Eagle,	Blair,	Feb. 15-16.

DR. J. H. FUNK, Boyertown, Berks County, Pa.

Will attend all meetings in Part one of the Second Section.

H. M. GOODERHAM, Patton, R. F. D. No. 1, Cambria County, Pa.

Town.	County.	Dates.
Warrensville,	Lycoming,	Jan. 4-5.
Jersey Shore,	Lycoming,	Jan. 6-7.
Loganton,	Clinton,	Jan. 8-9.

HORACE H. HALL, Ellisburg, Potter County, Pa.

Oliveburg,	Jefferson,	Feb. 17-18.
Paradise,	Jefferson,	Feb. 19-20.
Tylersburg,	Clarion,	Feb. 22-23.
Fryburg,	Clarion,	Feb. 24-25.
Callenburg,	Clarion,	Feb. 26-27.

JOEL A. HERR, Millhall, R. F. D., Clinton County, Pa.

Tunkhannock,	Wyoming,	Dec. 14-15.
Lovelton,	Wyoming,	Dec. 16-17.
Muncy Valley,	Sullivan,	Dec. 18-19.
Montgomery,	Lycoming,	Dec. 21-22.
Pineville,	Bucks,	Feb. 1-2.
Plumsteadville,	Bucks,	Feb. 3-4.
Sellersville,	Bucks,	Feb. 5-6.
Richland,	Bucks,	Feb. 8-9.

**PROF. P. H. HERTZOG, Division of Zoology, Dept. of Agriculture,
Harrisburg, Pa.**

Unionville,	Chester,	Jan. 13-14.
Oxford,	Chester,	Jan. 15-16.
Media,	Delaware,	Jan. 18-19.
Concordville,	Delaware,	Jan. 20-21.
Newtown Square,	Delaware,	Jan. 22.

W. F. HILL, Huntingdon, Huntingdon County, Pa.

St. Marys,	Elk,	Feb. 15-16.
Rasselas,	Elk,	Feb. 17-18.
Turtle Point,	McKean, -	Feb. 19-20.

E. S. HOOVER, Lancaster, Lancaster County, Pa.

Thompsonstown, ...	Juniata,	Feb. 1-2.
Academia,	Juniata,	Feb. 3-4.
Lewistown,	Mifflin,	Feb. 5-6.

HOMER W. JACKSON, Cambridge, Ohio, R. F. D. No. 1.

Town.	County.	Date.
Scenery Hill,	Washington,	Dec. 14-15.
Finleyville,	Washington,	Dec. 16-17.
West Middletown, .	Washington,	Dec. 18-19.
Union Church,	Allegheny,	Dec. 21-22.

DR. JOSEPH JOHNSON, Westgrove, Chester County, Pa.

Neffs,	Lehigh,	Feb. 19-20.
Allentown,	Lehigh,	Feb. 22-23.
Huffs Church,	Berks,	Feb. 24.
Virginsville,	Berks,	Feb. 25-26.
Geigertown,	Berks,	Feb. 27.

A. J. KAHLER, Hughesville, Lycoming County, Pa.

Gallilee.	Wayne,	Dec. 12.
Calkins,	Wayne,	Dec. 14-15.
Beech Lake,	Wayne,	Dec. 16-17.
Honesdale,	Wayne,	Dec. 18-19.
Paupack,	Pike,	Dec. 21-22.
Greentown,	Pike,	Dec. 23-24.
Thompsonstown,	Juniata,	Feb. 1-2.
Academia,	Juniata,	Feb. 3-4.
Lewistown,	Mifflin,	Feb. 5-6.
Belleville,	Mifflin,	Feb. 8-9.
Duncansville,	Blair,	Feb. 10-11.
Bellwood,	Blair,	Feb. 12-13.
Bald Eagle,	Blair,	Feb. 15-16.

DR. LOUIS A. KLEIN, Deputy State Veterinarian, Harrisburg, Pa.

Unionville,	Chester,	Jan. 13-14.
Oxford,	Chester,	Jan. 15-16.

R. P. KESTER, Grampian, Clearfield County, Pa.

Will attend all meetings in Part one of the Fifth Section from January 4-25 and Part one of the First Section February 15-March 6.

J. H. LEDY, Marion, Franklin County, Pa.

Rossville,	York,	Feb. 8-9.
Dillsburg,	York,	Feb. 10-11.
Quarryville,	Lancaster,	Feb. 12-13.
Lampteder,	Lancaster,	Feb. 15-16.
Maytown,	Lancaster,	Feb. 17-18.
Ephrata,	Lancaster,	Feb. 19-20.
Cedarville,	Chester,	Feb. 22-23.
King of Prussia, ...	Montgomery,	Feb. 24-25.
East Greenville, ...	Montgomery,	Feb. 26-27.

AMOS B. LEHMAN, Fayetteville, Franklin County, Pa.
Town. County. Dates.

St. Marys, Elk, Feb. 15-16.
 Rasselas, Elk, Feb. 17-18.
 Turtle Point, McKean, Feb. 19-20.

L. W. LIGHTY, East Berlin, Adams County, Pa.

Will attend all meetings in Part one of the Second Section.

PROF. T. I. MAIRS, State College, Centre County, Pa.

Grove City,	Venango,	Feb. 26-27.
Polk,	Mercer,	Mar. 1-2.
West Virginia,	Mercer,	Mar. 3-4.
Hadley,	Mercer,	Mar. 5-6.

CLARENCE C. McCURDY, Hartstown, Crawford County, Pa.

East Brook, Lawrence, Jan. 11-12.
Harlansburg, Lawrence, Jan. 13-14.
Plaingrove, Lawrence, Jan. 15-16.

M. S. McDOWELL, State College Centre County, Pa.

Will attend all meetings in Part two of the First Section and Part one of the Fourth Section from February 1 to March 4.

PROF. FRANKLIN MENGES, York, York County, Pa.

Will attend all meetings in the Fifth Section.

H. E. MOATS, Jamestown, Mercer County, Pa.

Slippery Rock,	Butler,	. . . . .	Jan. 18-19.
Renfrew,	Butler,	. . . . .	Jan. 20-21.
Mars,	Butler,	. . . . .	Jan. 22-23.
Grove City,	Mercer,	. . . . .	Mar. 1-2.
West Virginia,	Mercer,	. . . . .	Mar. 3-4.
Hadley,	Mercer,	. . . . .	Mar. 5-6.

H. W. NORTHUP, Dalton, D. F. D. No. 1, Lackawanna County, Pa.

New Albany,	Bradford,	Nov. 27-28.
Ulster,	Bradford,	Nov. 31-Dec. 1.
Leraysville,	Bradford,	Dec. 2-3.
Lime Hill,	Bradford,	Dec. 4-5.
Oliveburg,	Jefferson,	Feb. 17-18.
Paradise,	Jefferson,	Feb. 19-20.
Tylersburg,	Clarion,	Feb. 22-23.
Fryburg,	Clarion,	Feb. 24-25.
Callensburg,	Clarion,	Feb. 26-27.

PROF. WM. G. OWENS, Lewisburg, Union County, Pa.

Town.	County.	Dates.
Scenery Hill,	Washington,	Dec. 14-15.
Finleyville,	Washington,	Dec. 16-17.
West Middletown, .	Washington,	Dec. 18-19.
Union Church,	Allegheny,	Dec. 21-22.

J. P. PEACHEY, Belleville, Mifflin County, Pa.

Will attend all meetings in Part one of the Third Section.

PROF. CHAS. L. PENNY, State College, Centre County, Pa.

Swissdale,	Clinton,	Jan. 11-12.
Woolrich,	Clinton,	Jan. 13-14.
Wellboro,	Tioga,	Jan. 15-16.

T. J. PHILIPS, Atglen, Chester County, Pa.

Will attend all meetings in Part two of the First Section; Part two of the Second Section; Part two of the Third Section; Part two of the Fourth Section.

E. L. PHILLIPS, New Bethlehem, Clarion County, Pa.

McConnellsburg, ...	Fulton,	Dec. 11-12.
Hustonton,	Fulton,	Dec. 14-15.
Clearville,	Bedford,	Dec. 16-17.
Mench,	Bedford,	Dec. 18-19.
Imlerton,	Bedford,	Dec. 21-22.

PROF. J. P. PILLSBURY, State College, Centre County, Pa.

Waynesburg,	Greene,	Dec. 1-2-3.
Newtown,	Greene,	Dec. 4-5.

B. MONROE POSTEN, Sheakleyville, Mercer County, Pa.

Dunbar,	Fayette,	Feb. 1-2.
Perryopolis,	Fayette,	Feb. 3-4.
Scottsdale,	Westmoreland,	Feb. 5-6.
Harrison City,	Westmoreland,	Feb. 8-9.
New Kensington,	Westmoreland,	Feb. 10-11.
New Texas,	Allegheny,	Feb. 12-13.
Culmerville,	Allegheny,	Feb. 15-16.
Apollo,	Armstrong,	Feb. 17-18.
Tidal,	Armstrong,	Feb. 19-20.
Oak Ridge,	Armstrong,	Feb. 22-23.
Breedtown,	Venango,	Feb. 24-25.

CHAS. H. RICH, Woolrich, Clinton County, Pa.

Town.	County.	Dates.
Warren,	Warren,	Feb. 8-9.
Tionesta,	Forest,	Feb. 10-11.
Marionville,	Forest,	Feb. 12-13.

A. B. ROSS, Schellsburg, Bedford County, Pa.

Bath,	Northampton,	Feb. 15-16.
Macungie,	Lehigh,	Feb. 17-18.
Neffs,	Lehigh,	Feb. 19-20.
Allentown,	Lehigh,	Feb. 22-23.

R. F. SCHWARZ, Analomink, Monroe County, Pa.

Will attend all meetings in Part one of the Fourth Section from January 4-22 and Part one of the Third Section from February 1-25.

OIVER D. SCHOCK, Asst. Dairy and Food Commissioner, Harrisburg, Pa.

Fannettsburg,	Franklin,	Nov. 30.
Dry Run,	Franklin,	Dec. 1-2.
St. Thomas,	Franklin,	Dec. 3-4.
Marion,	Franklin,	Dec. 5.

ROBT. S. SEEDS, Birmingham, Huntingdon County, Pa.

Will attend all meetings in the Fifth Section from January 4-25 and Part one of the First Section from February 1-20.

A. W. STEPHENS, Lewisburg, Union County, Pa.

Tunkhannock,	Wyoming,	Dec. 14-15.
Lovelton,	Wyoming,	Dec. 16-17.
Muncy Valley,	Sullivan,	Dec. 18-19.
Montgomery,	Lycoming,	Dec. 21-22.

PROF. J. P. STEWART, State College, Centre County, Pa.

Fannettsburg,	Franklin,	Nov. 30.
Dry Run,	Franklin,	Dec. 1-2.
St. Thomas,	Franklin,	Dec. 3-4.
Marion,	Franklin,	Dec. 5.

W. H. STOUT, Pinegrove, Schuylkill County, Pa.

Gallilee,	Wayne,	Dec. 12.
Calkins,	Wayne,	Dec. 14-15.
Beech Lake,	Wayne,	Dec. 16-17.
Honesdale,	Wayne,	Dec. 18-19.

Town.	County.	Dates.
Paupack,	Pike,	Dec. 21-22.
Greentown,	Pike,	Dec. 23-24.
Mansfield,	Tioga,	Jan. 18-19.
Tioga,	Tioga,	Jan. 20.
Osceola,	Tioga,	Jan. 21-22.
Knoxville,	Tioga,	Jan. 23.

MISS SARA PHILLIPS THOMAS, Wayne, R. F. D. No. 1, Delaware County, Pa.

Media,	Delaware,	Jan. 18-19.
Concordville,	Delaware,	Jan. 20-21.
Newtown Square,	Delaware,	Jan. 22.
Center Point,	Montgomery,	Mar. 3-4.
Schwenksville,	Montgomery,	Mar. 5-6.
Bustleton,	Philadelphia,	Mar. 8-9.

PROF. H. E. VAN NORMAN, State College, Centre County, Pa.

Erie,	Erie,	Feb. 8-9.
Meadville,	Crawford,	Feb. 10-11.
Townville,	Crawford,	Mar. 1-2.
Linesville,	Crawford,	Mar. 3-4.
Espyville,	Crawford,	Mar. 5.

LEON OTICE VAN NOY, Troy R. F. D. No. 66, Bradford County, Pa.

New Albany,	Bradford,	Nov. 27-28.
Ulster,	Bradford,	Nov. 31-Dec. 1.
Leraysville,	Bradford,	Dec. 2-3.
Lime Hill,	Bradford,	Dec. 4-5.

F. J. WAGNER, Harrison City, Westmoreland County, Pa.

Blairsville,	Indiana,	Nov. 27-28.
Dilltown,	Indiana,	Nov. 30-Dec. 1.
Willet,	Indiana,	Dec. 2-3.
Flora,	Indiana,	Dec. 4-5.

MRS. MARY A. WALLACE, Beechwood and Shaw Aves., Pittsburgh, Allegheny County, Pa.

Blairsville,	Indiana,	Nov. 27-28.
Dilltown,	Indiana,	Nov. 30-Dec. 1.
Willet,	Indiana,	Dec. 2-3.
Flora,	Indiana,	Dec. 4-5.
Penfield,	Clearfield,	Jan. 4-5.
Troutville,	Clearfield,	Jan. 6-7.
Woodland,	Clearfield,	Jan. 8-9.
Patton,	Cambria,	Jan. 11-12.
Nicktown,	Cambria,	Jan. 13-14.
Somerset,	Cambria,	Jan. 15-16.
Wilmore,	Somerset,	Jan. 18-19-20.
Rockwood,	Somerset,	Jan. 21-22.

PROF. R. L. WATTS, State College, Centre County. Pa.

Town.	County.	Dates.
King of Prussia,	Montgomery,	Feb. 24-25.
East Greenville,	Montgomery,	Feb. 26-27.
Beyers,	Chester,	Mar. 1-2.

D. H. WATTS, Kerrmoor, Clearfield County, Pa.

Will attend all meetings in Part one of the Third Section from Jan. 4 to Jan. 23 and Part one of the Fourth Section from Feb. 22 to March 4.

G. B. WAYCHOFF, Jefferson, Greene County, Pa.

Will attend all meetings in the Fifth Section from Feb. 15 to March 9.

R. J. WELD, Sugargrove, Warren County, Pa.

Dalmatia,	Northumberland,	Feb. 1-2.
Pottsgrove,	Northumberland,	Feb. 3-4.
McEwensville,	Northumberland,	Feb. 5-6.
Washingtonville, ...	Montour,	Feb. 8-9.
Moorsburg,	Montour,	Feb. 10.
Mt. Pleasant Mills..	Snyder,	Feb. 11-12-13.

CHAS. A. WILSON, Stewartstown, R. F. D. No. 4, York County, Pa.

Fannettsburg,	Franklin,	Nov. 30.
Dry Run,	Franklin,	Dec. 1-2.
St. Thomas,	Franklin,	Dec. 3-4.
Marion,	Franklin,	Dec. 5.

W. THEO. WITTMAN, Allentown, Lehigh County, Pa.

Will attend all meetings in the Fifth Section from Dec. 12 to Dec. 24 and Part one of the First Section Feb. 22 to March 9; also Moveable Institute Schools, Bloomsburg, Jan. 15 and 16, East Smethport Feb. 8 and 9, Erie, Feb. 10 and 11 and Meadville, Feb. 12 and 13.

WM. H. WOLFF, West Chester, Chester County, Pa.

S. PAUL WOODMAN, Rushland, Bucks County, Pa.

Will attend all meetings in Part one of the First Section from Jan. 4 to Jan. 23.

MRS. SARAH B. F. ZEIGLER, Duncannon, Perry County, Pa.

Town.	County.	Date.
Middle Springs,	Cumberland,	Dec. 14-15.
New Kingston,	Cumberland,	Dec. 16.
Hogestown,	Cumberland,	Dec. 17.
Chuchtown,	Cumberland,	Dec. 18-19.
Matamoras,	Dauphin,	Dec. 21-22.
Girard,	Erie,	Feb. 1-2.
Millvillage,	Erie,	Feb. 3.
Columbus,	Warren,	Feb. 4-5.
Lottsville,	Warren,	Feb. 6.
Warren,	Warren,	Feb. 8-9.
Tionesta,	Forest,	Feb. 10-11.
Marionville,	Forest,	Feb. 12-13.

MRS. MOLLIE MacCLAUGHRY ALLEN was graduated from Cornell University, class of '93, having specialized in chemistry. She spent the next year in graduate work in chemistry and then taught science in the high schools of New York and Louisiana. Failure of health caused retirement to the country, where she became interested in agriculture and especially in poultry culture and fruit growing. This she has pursued for some years successfully and now has sole charge of the farm in Oswego county, N. Y. She is a member of the Institute force of New York state and has been called to deliver lectures before the class in Home Economics at Cornell University. She is an enthusiastic advocate of home sanitation and out-of-door work for women.

RICHARD D. BARCLAY graduated from the School of Agriculture of The Pennsylvania State College in 1905 and was granted the degree of Master of Science by that Institution in 1908. Demonstrator in Annual Nutrition at the College and Station Exhibit, St. Louis; Assistant Manager 1905 and Manager 1906 to 1908 of "Dolobran" and "Loopstown Farm"; the estate and farm of C. A. Griscom, Esq., Haverford, Pa.; Systematizer of Farm Accounts and Stock Records, 1908, and President of the Scientific Spraying Co., 1908. Engaged in bee keeping since 1899.

S. F. BARBER was born in Union county, Pa., in 1855, was educated in the public schools and worked upon a farm until he was twenty-one. He then went into the mercantile business; 1877-8 was in the employ of the Buck Mountain Coal Company, in Luzerne county, as general manager of their company store, and in 1879-80 was in charge of the company store of the Stout Coal Company. Afterwards traveled in the West, particularly in Colorado, and then spent one year traveling for a dry goods firm in Philadelphia. In 1881 he settled down to farming, and has been engaged in that business ever since. His specialty is dairying, although he raises the general crops usual upon a Dauphin county farm.

WM. C. BLACK was born on a farm in Mercer county; educated in the common schools and at Westminster College a soldier in the Civil War; a teacher in the common schools and a farmer in his native county, raising general farm

crops and breeding Shorthorn cattle. He has been a successful exhibitor of animals of his own breeding at the principal fairs in Western Pennsylvania. He has been a diligent reader of the best farm and live stock journals, visited some of the best farms and herds in the United States and Canada, and attended the great live stock exhibits.

M. S. BOND was born on a farm in Montour county, Pa., February 26, 1834; lived and worked on a farm until eighteen years old, then taught school seven years, then was employed as a freight and passenger conductor for nine years, and traveled as lost freight and car tracer and purchasing agent for the Delaware, Lackawanna and Western Railroad Company for five years. Has been for over twenty-five years engaged in farming and market gardening; during a part of this time, engaged in breeding and raising blooded Jersey cattle and still keeps some of the best in the State; has made the raising of potatoes by the thousands of bushels a specialty for twenty-five years; has been and is now using more fertilizer to the acre than any man in his county, and is now making gardening a specialty.

DR. C. W. BRODHEAD was born December 20, 1852, near White Haven, Luzerne county, Pa. He received a common school education; commenced to work in a horseshoeing shop at 16 years of age; worked six years at the business when he began to study anatomy and to dissect feet and legs and the head under the instructions of an English veterinarian and has been a student of the best authors and in actual practice ever since; and is registered under the laws of Pennsylvania as a specialist as a veterinary dentist, animal castrations and pathological horseshoeing, and has been lecturing before institutes and farmers' organizations for the last ten years, when not in actual practice in Pennsylvania and adjoining states.

MRS. C. W. BRODHEAD was born in Rush, Susquehanna county, Pa., in the year 1864. Her father, Samuel Smith, was a successful farmer and butcher. She was educated in the public schools and always took an active part in all literary and social entertainments, even until the present time. She has always lived on a farm, taking particular interest in poultry with the exception of three years, and now in connection with her household duties, in taking care of an experimental flock of purebred poultry at her village home in Montrose, Pa. She is a member of the Farmers' Alliance and Daughters of Veterans. She is also a close student of all that goes to make up a happy rural or village home.

JOHN WESLEY BRUCKART was born on his father's farm in West Hempfield township, Lancaster county, Pa., in 1857. Received a common school education and taught school in his native county a number of years. His health failing, he farmed the home place and began the raising of pure bred fowls. A dozen years ago he secured a place of thirteen acres adjoining Lititz borough. Here he has combined the business of market gardening and the growing of pure bred poultry with marked success. The annual income from his thirteen acre farm exceeding the income of the majority of farms ten times as large.

J. S. BURNS was born February 22, 1847, on the farm he now owns, near Clinton, Pa. His father died when he was seven years old, and from that time until he was twenty-one he worked upon the farm as hired help, receiving his board and clothing, and attending the public schools in the winter. His education received a brief finish at Linnean Academy, at Clinton. He was married when twenty-one, and soon after bought out the other heirs, and

from the farm made the money that eventually paid for it. He has kept strict account of every item of income and expense since he was twenty-one years old, and to this habit of careful accounting he attributes much of his success. He has had large experience in the breeding and care of all lines of farm stock, but during recent years has given more special attention to the breeding of Poland-China swine, and raising mutton lambs, together with the growing of all the different crops usually raised on a Western Pennsylvania farm. He has had considerable experience as a correspondent upon agricultural topics, and for a number of years has taken an active part in the Institute work of this State.

J. T. CAMPBELL was born in Springhill township, Fayette county, Pa., December 18, 1872; is the son of a prominent farmer; received his early education in the public schools of his native district; left the public schools with a more than average education, and at once took up the study of agriculture at home, while working on his father's farm; he studied carefully all leading books and journals of his day. Married in 1894, and took up gardening and poultry culture, and was successful from the start. When the Pennsylvania State College started its Correspondence Courses in Agriculture he took up the work and has since pursued same with diligence. Owns a large farm in Crawford county, upon which he has worked out many important agricultural problems. In poultry culture he has been especially successful, having made it a subject of special study, together with soil physics. Keeps in close touch with the State Experiment Station and the National Department of Agriculture; has written some for various agricultural and poultry journals.

DR. MILTON E. CONARD was born in Southern Chester county in 1851 of an ancestry of successful agriculturists. He obtained his education in the Public and High schools and Millersville State Normal School. He was for some years engaged in farming in his home locality; later taking the course in veterinary medicine at the University of Pennsylvania, graduating in 1891, in which institution he has for several years been lecturer of Dairy and Milk Inspection and Veterinary Obstetrics. Throughout his veterinary career he has been closely identified with dairy interests, practicing for some years in a dairy locality, and having for over ten years given his entire time as Inspector and Consulting Expert for a number of the dairies furnishing milk to the City of Philadelphia from Pennsylvania, New Jersey, Maryland and Delaware.

M. N. CLARK was born near Export, Westmoreland county, Pa., July 16, 1848; received a good common school education, with several years at an academy and a full course at Duff's Commercial College, at Pittsburg; has always taken much delight in farming; is a close observer, and for many years has taken an active interest in agricultural affairs of his county; the cause of education has always found in him an earnest supporter; has been engaged in general farming from boyhood, except a few years spent in selling implements; was several seasons in the fruit growing regions of the South, and there gained much information in the use of commercial fertilizers and fruit growing; has been a member of the State Board of Agriculture for ten years, and at present is looking after the interest of his farm.

JOHN W. COX was born near New Wilmington, Lawrence county, Pa., December 27, 1868; received a common school education and a course at Duff's Commercial College, Pittsburg; has spent all his life on the farm; is a breeder of Jersey cattle on his 200-acre farm, besides Barred Plymouth Rock poultry. Wheat, oats, corn, hay and potatoes are his principal crops; is much

interested in the education of the farmers' children, and is serving his third three-year term as school director; is pursuing the Correspondence Course of the Pennsylvania State College.

M. EARL CARR, B. S., of the United States Department of Agriculture, Bureau of Soils, Washington, D. C., was born on a farm in Western New York. His early life was spent in the neighborhood of his birth. After leaving the county district school he attended Chamberlain Institute, Randolph, N. Y. Upon graduating there he taught school for a portion of three years. In the fall of 1899 he matriculated in the science course at Syracuse University, Syracuse, N. Y. While in college he specialized in chemistry and geology, being an assistant in the chemical laboratory during his junior and senior years. April 1, 1903, Mr. Carr was appointed in the Bureau of Soils of the United States Department of Agriculture, his college work being in such shape that he was excused from attendance from the above date until the close of the college year in June, when he was given the degree of Bachelor of Science. For the past four years Mr. Carr has been employed in the Soil Survey Work of the Bureau of Soils, working in the different states and publishing jointly with others nine reports. During the present season, 1907, he has been detailed to make an investigation of the "abandoned farm" situation of southern New York and northern Pennsylvania as related to soils. Last winter he was elected to alumni membership in Ph Chi Phi, an honorary chemical fraternity at his Alma Mater.

NORMAN BRUCE CRITCHFIELD was born in Somerset county, July 20, 1838; was educated in the public and normal schools of his native county, and at the Ohio University, located at Athens, Ohio; he is by occupation a farmer; during the Civil War he served nine months in the One Hundred and Seventy-first Pennsylvania Militia, and at the close of his term entered the Twenty-eighth Pennsylvania Volunteers, with which regiment he continued until the close of the war; he has held in his own county the position of school director, county superintendent of public schools, prothonotary and clerk of courts, elected to the Senate, November 4, 1890; appointed judge in the Department of Agriculture at the World's Columbian Exposition in 1893, and served as vice president and chairman of the board of judges in said department; was re-elected to Senate in 1894, and appointed Secretary of Agriculture, February 24, 1903, and reappointed by Gov. Stuart, February 25, 1907.

Z. T. CURE was born in 1848, and attended the public schools, including the city high school, until seventeen years of age, after which he taught school for five years, and has followed farming and stock raising ever since. His school training has been supplemented by extensive reading courses, which, by the aid of free translations, covered the subjects taught in college courses, with the exception of higher mathematics. As sources of information on the topics which he discusses, he depends upon experience and observation, aided by Prof. L. H. Bailey, of Cornell University, in the domain of horticulture and kindred subjects, and Andrew S. Fuller on the propagation of plants, etc., and other publications of authority, together with a careful perusal of the best agricultural periodicals of the day and a studious consultation of the latest bulletins of the Experiment Stations. He has had considerable experience in the discussion of literary and scientific subjects before teachers' institutes, and has made a careful study of the topics chosen to present at farmers' institutes.

J. D. DETRICH'S knowledge of agriculture, as a science, dates from 1882, since which time he has been availing himself of all the bulletins, magazines and books relating to soil, crops, dairying, breeding, feeding and rearing of dairy animals. This, together with information furnished by the colleges and experiment stations, he has put into practice, and the result has been a satisfactory and profitable system of extensive farming.

W. M. C. DRAKE was born in Lawrence county, August 16, 1860. He was educated at the public schools and a formal school at New Castle, Pa., passing a teachers' examination. He has spent all of his life on the farm; was president of the farmers' Alliance in Lawrence county one term. He has been for several years past in partnership with his brother, operating 600 acres of land, besides a market garden and an extensive orchard.

I. A. ESCHBACH was born May 19, 1854, at Fallowfield on the farm he now owns near Milton, Northumberland county, Pa. His education was in the common schools, with a little finishing up at Academy at McEwensville, Pa. Married at twenty-one and has always been engaged in farming, has always taken an active interest in local affairs of his section, serving as school director for thirteen successive years; served as President of Board of Directors of Milton Fair Association; is at present chairman of good roads movement in his own county and member of the State Board of Agriculture in same. He has been a success as a farmer and stock-raiser. Breeding horses, cattle and sheep and hogs, together with raising all the general farm crops raised in his section. He has always taken active interest in Institute work in his county and is at home on all agricultural topics.

F. H. FASSETT, Meshoppen, Pa., was born June 3, 1855, in Windham township, Wyoming county, Pa.; moved to Meshoppen township in 1869 to the farm where he now resides; was educated in the common schools and a course in select school in Meshoppen borough; has been actively engaged in the growing of tree fruits with marked success for the past 25 years; all up-to-date methods of orchard treatment, spraying and pruning have been in use; took up the business of growing small fruits for the market some 12 years ago and has met with fair success. Is President of Wyoming County Horticultural Society and in close touch with the fruit interest of this section.

WILLIAM FREAR was born in 1860, in Reading, Pa. He was educated in the public schools of that city and of Norristown, entered the preparatory and later the collegiate department of Bucknell University, graduating in 1881; pursued a post graduate course at Illinois, Wesleyan and Harvard Universities. Spent the growing season of the year during his childhood and youth at work upon a Pennsylvania farm; was made assistant chemist to the United States Department of Agriculture, 1883-5, and was engaged in sugar-beet products and cereals. In 1885 he was elected professor of agricultural chemistry in the Pennsylvania State College, and in 1887 was made vice-director and chemist to the Pennsylvania State College Experiment Station. In 1888 he was elected chemist to the Pennsylvania Board of Agriculture, and in 1895 chemist to the Pennsylvania Department of Agriculture. He was also president of the National Association of Agricultural Chemists, and has been one of the leading lecturers upon the State force of Farmers' Institutes.

HORACE H. HALL, of the "Triplet Oak Farm," was born on a farm near Coudersport, Potter county, Pa., in 1853. He received most of his education in the common schools, though he attended the Emporium graded and the Coudersport high schools for a limited time. He received his first teacher's cer-

tificate when twenty and taught in the schools of Potter county for twenty years, mostly in the district schools, though he served as principal of the Galeton and Oswayo graded schools. When not engaged in teaching, he worked at farming or in the lumber woods. At forty he turned his whole attention to farming, having bought 114 acres of bark slashing and woods, which he stocked with sheep while he was clearing and stumping, and in about ten years he has logged and stumped fifty acres, built substantial farm buildings, changed from a sheepman to a successful dairymen, and is a large producer of the finest strawberries.

JOEL A. HERR was born in Clinton county, Pa., and educated in the public schools and at Dickinson Seminary. He served in the Civil War and has been a student, teacher and farmer all his life. He lives now on his farm and gives special attention to fruit culture and stock raising. He is a member of the State Board of Agriculture.

P. H. HERTZOG was born on a farm near Ephrata, Lancaster county, Pa., September, 1880. He was educated in the public schools of his native township, afterwards at the Millersville State Normal School. Taught public school for three terms. He has had practical experience at fruit growing, tobacco raising and lumbering. He taught Chemistry and Zoology at the Millersville State Normal School for three years. He has been a non-resident assistant in the collection and study of plants and seed for the Bureau of Plant Industry, U. S. Department of Agriculture for several years past. Since the summer of 1906 is filling a position in the Division of Zoology at Harrisburg, doing research and experimental work along economic lines.

WILLIAM FREE HILL was born in '67 in South Shenango township, Crawford county, Pa. Attended different schools until he was sixteen, after which, three years were spent at Allegheny College. Returning from college to the farm he was successful, and after his father's early death bought more land until four hundred acres were under his management. Grange work soon made heavy demands upon him and he removed his family to Franklin county, a more central location in the State. Elected lecturer of the State Grange 1894-98. Since that time has been Master of the State Grange continuously. In 1901 was elected a trustee of the Pennsylvania State College and has been re-elected twice since. Is a member of the Advisory Committee of the Experiment Station and assists in determining the nature and character of the experimental work of this institution. In 1905 was appointed by President Roosevelt as one of three delegates to represent the United States government at the International Congress of Agriculture at Rome, Italy. Living now at Huntingdon, is devoting his attention to truck farming, to the extension of organization among farmers, and assisting in the establishment and operation of a chain of Grange banks throughout the State.

E. S. HOOVER was born in Lancaster county, Pa., in 1839; was educated in the public schools, White Hall Academy and the State Normal School at Millersville, taught school four terms, owns and controls a farm. Is engaged in general farming, at one time gave special attention to growing and feeding of live stock, especially in raising and training horses, and, later, devoted himself to the horticultural branch of agriculture. Acquired knowledge of agriculture by study, actual experience and experimenting. Is at present time a member of the board of trustees of Millersville State Normal School; was a member of the Legislature, 1883-1884; has for some time and is at present engaged in Farmers' Institute work.

GEORGE E. HULL, the subject of this sketch, a number of years ago moved upon a worn-out farm without buildings in Mercer county. By industry, perseverance and intelligent effort he has succeeded in restoring it to the highest state of fertility; has placed thereon substantial and convenient farm buildings, and educated his children, without other income than that derived from the farm. His silos, stock scales, farm implements and improved live stock are the admiration of all progressive farmers.

A. J. KAHLER was born in Hughesville, Pa., in 1834; was educated in the public schools and afterwards taught school in his native county; has always lived upon a farm; has filled every local office in his township; was a member of the Legislature in 1891-1892; was president for six years of the County Agricultural Society; is a member of the State Board of Agriculture and has been identified with most of the leading farm organizations of the State.

KESTER, R. P., was born in Clearfield county, Pa., January 18, 1867. He now resides on the farm which his maternal great grandfather "took-up" and partially cleared nearly 100 years ago. It was farmed for 80 years in the old way and the fertility was depleted until it was one of the "worn out" farms. During the past few years Mr. Kester and his younger brother have been farming and dairying by modern methods, until now even five blades of grass grew where one grew before. Their leading business is dairying, although fruit, poultry and trucking receive attention. He was for 15 years a teacher and always a close student. And by learning from others and by experiments is making the old homestead farm pay.

J. H. LEDY was born in Marion, Franklin county, Pa., August 3, 1864, and received his education in the common schools of Guilford township and at the Chambersburg Academy. After leaving school he engaged in the mercantile business for seven years at Marion and Waynesboro, Pa. In the spring of 1889 he accepted a position with S. Smucker and Co., wholesale grocers of Philadelphia. He remained with this firm four years, when he was elected register and recorder of Franklin county, after which he became half owner and business manager of the People's Register, of Chambersburg, and independent journal of large circulation. He now owns and superintends 151 acres of apple trees, inlaid with peaches and plums. Mr. Ledy is a practical fruit grower, who loves the work and has turned his whole attention to it.

A. B. LEHMAN was born on the old Lehman homestead at Scotland, Pa., September 9th, 1859. Attended the public schools and taught three terms under County Superintendent, Prof. Aaron Sheely, of Adams county, Pa. After the death of his grandfather, he moved upon the farm and has been engaged in his chosen line of work until the present time. He has devoted considerable time to the raising of hogs and cattle, and the growing at times of special crops, onions, potatoes and sweet corn for making a special product, evaporated sweet corn. At present is improving an abandoned farm by drainage, fertilization and cultivation, after the latest scientific methods under the direction of Farmers' Institute teaching.

L. W. LIGHTY was born in York county, Pa., in 1857; attended the public schools of his neighborhood; afterwards attended a select school in Adams county and then taught school for seven winters. During this time he attended the York County Academy one term and also attended the State Normal School at Millersville. He then kept store, but not liking the business, he got out of it, and started in the poultry business, keeping both market and fancy poultry, and engaged in bee-keeping and the culture of

small fruits. In 1893 he purchased the farm upon which he now lives. The land was worn out and the buildings quite dilapidated. He has improved the soil until it is now one of the best farms in the county. He has a large library of standard books, keeps a selected dairy of cows, and has all the modern improvements needed to equip a first-class farm.

THOMAS I. MAIRS spent his early life upon a stock farm and graduated from the College of Agriculture of the University of Missouri in 1896. He took graduate work at the Michigan Agricultural College, the University of Illinois and the University of Missouri. He was Superintendent of Field Experiments at the University of Illinois in 1896-7, and Assistant in Agriculture at the University of Missouri from 1897 to 1901. Since 1901 he has been connected with the Pennsylvania State College, as Assistant Superintendent of Correspondence Courses and Assistant Professor of Animal Husbandry. He has taught Dairy and Animal Husbandry and has had charge of the experimental work along these lines.

M. S. McDOWELL was born in Mifflin county, Pa.; attended the public schools, and Lewistown Academy; entered Pennsylvania State College in 1888, and was graduated in '92; after graduation was connected with a fertilizer manufacturing establishment in Baltimore, and later came to the chemical department of the Experiment Station, with which he has been connected for six years.

A. L. MARTIN was born near Mount Jackson, Lawrence county, Pa., in 1844; received his education in the public schools and at Poland (Ohio), College; served as school director in his native township and that of Little Beaver for eight years; filled the position of census enumerator in 1890; was elected to the House of Representatives in 1892, and served continuously until 1899; was during this continued service a member of the Agricultural Committee, and acted as its chairman in the session of 1897; by appointment of Governor Pattison, in 1893, became member of Farmers' National Congress and has been reappointed to same position by all subsequent Governors. Was appointed by Governor Stone, April 24, 1899, Deputy Secretary of Agriculture and Director of Farmers' Institutes for Pennsylvania, and reappointed by Governor Pennypacker, April 24, 1903, and also by Governor Stuart, April 24, 1907.

PROF. FRANKLIN MENGES, Ph. D., was born forty-six years ago at Menges' Mill, York county, Pa.; the first nineteen years of his life were spent on his father's farm, with all the ardor that farming meant in those days; he then began a course of preparation for college at the Baugher Academy, Hanover, Pa., and entered and graduated from Pennsylvania College, Gettysburg, with the class of 1886; was immediately tendered and accepted the position of assistant professor of chemistry in his Alma Mater, which position he held until 1896, when he came to York and took up the professorship of the sciences in the York High School, which position he now holds; received the degree of Ph. D. from his alma mater for special work in chemistry, mineralogy and physics. He has for years been a student of the "Experiment Station Record," and has continued an interest in practical agriculture, and has lectured before Farmers' Institutes.

HENRY W. NORTHUP was born on a farm in Abington, once considered the banner agricultural township in Luzerne county; he was educated in the public schools and at Madison Academy. His chief business is that of farmer and dairyman; has been greatly benefited in this line of business for the

last ten years by having associated with some of the best and most practical agriculturists in this and adjoining States in the institute work; has had some experience in fruit and market gardening and in disposition of these products in the city of Scranton, where an excellent market has been secured.

PROF. WM. G. OWENS, of Bucknell University, was born in Union county; received his early education in the public schools of Lewisburg, Pittsburg and Allegheny City. Entered Bucknell University 1876; was graduated 1880; took his A. M. in 1883; taught in Bucknell University five years after graduation. In 1885 he became instructor in Natural Sciences. Took special work at Harvard and Berlin, Germany. In 1887 became professor of Chemistry and Physics, the position which he now holds. Has spent almost all his vacations on a farm and thus kept in close touch with Nature.

J. H. PEACHEY was born in Mifflin county, Pa., in 1851. His boyhood was spent upon a farm; was educated in the public schools and graduated from the Ohio Normal University in 1881. After completing his course at school he followed teaching. In 1887 he began farming for himself and gave attention chiefly to raising hogs, sheep and cattle.

DR. LEONARD PEARSON, State Veterinarian, was born in Indiana, August 17, 1868. In 1884 he entered Cornell University, and graduated in 1888 in the agricultural course. He graduated from the Veterinary Department of the University of Pennsylvania in 1890. During 1890-91 he attended lectures in the veterinary schools of Berlin and Dresden. In 1892 Dr. Pearson was appointed non-resident lecturer on veterinary science at the Pennsylvania State College. He was appointed State Veterinarian in 1896, was reappointed by Governor Stone, and immediately thereafter was elected secretary of the State Livestock Sanitary Board. He was again reappointed by Governor Pennypacker and Governor Stuart, and died September 20, 1909.

THOMAS J. PHILIPS was born upon a farm in Chester county, Pa., December, 1846; attended public and private schools and graduated from Bucknell University in 1867; spent three years in manufacturing iron, and traveling, and then settled upon the farm where he still lives, giving special attention to dairying and raising dairy stock, but devoting much of the 200-acre farm to the production of mixed crops, suitable to that location and market. That he has been a success is attested by the fact that he has been a director in a national bank for many years, a manager in one of the largest fire insurance companies in the State, and of a building and loan association; served two terms in the State Legislature, as a representative of the farming interests; he has contributed acceptably from time to time of his experience to the agricultural press, and in every way has kept in the front among the most progressive of his locality, believing in higher education, attractive country homes, and that success is the result of individual effort and judgment.

E. L. PHILLIPS was born on his father's farm in Clarion county, Pa. Was educated in the common schools and a course in the High School at Reid Institute, Pa. Since then he has studied extensively in agriculture. Was married in 1885, after which he devoted his time to agriculture, owning and operating his 200 acre farm with profit to himself. Said farm is in Clarion county, Pa. He has devoted his farm chiefly to the production of fruits, live stock and grain suitable to that location and market. He has been an experimenter with various plant foods. His real estate holdings and commercial standing are a strong recommendation to himself and to the farm.

J. P. PILLSBURY was born at Buena Vista, Ohio, in 1873. He was educated in the common schools of that State and the High School of Newark, Ohio. By competitive examination he secured a scholarship in the Missouri Botanical Gardens and Shaw School of Botany, St. Louis, Mo., where he completed a full four years' course of practical and scientific instruction in all branches of Horticulture. After his graduation he became the head gardener of the Pennsylvania State College and Experiment Station and was promoted to Assistant in Horticulture in 1898, which position he still holds. Mr. Pillsbury has had unexcelled opportunities for the study of the practical problems in horticulture and has written several bulletins and reports of his experience with fruits at the Experiment Station.

REV. B. MONROE POSTEN was born in Stroudsburg, Monroe county, Pa., educated in the public schools, and then attended business college in Newark, N. J. Was bookkeeper for Thos. A. Edison and M. Goulds Son and Co., the largest business of its kind in the world. He studied for the ministry, ordained in 1895, and has been in the pastorate ever since. Began raising fancy poultry, 1902, winning over 500 premiums at leading shows for excellence. Writes for a number of poultry and farm papers. Is president of borough council and president of board of education in home town. Has shipped poultry and eggs to every state and Panama as well as Burma.

OLIVER D. SCHOCK was born on a farm near Hamburg, Berks county, Pa., in 1858, and has always taken a deep interest in agricultural and horticultural affairs. He was educated in the common and high schools, including a course in a commercial and scientific academy. At the age of fifteen he became a newspaper correspondent, and continues to represent leading daily papers and agricultural journals. For a number of years he served as a special agent of the Pennsylvania State Board of Agriculture, and later as a clerk in the office of the Board, assisting Secretary Edge. With the creation of the Department of Agriculture, in 1895, Governor Hastings promoted Mr. Schock to the position of Chief Clerk in that Department, which position he filled until July, 1899. After several years' experience in mercantile pursuits, he was appointed, in the spring of 1903, under Governor Pennypacker's administration, to the position of Assistant Dairy and Food Commissioner of Pennsylvania, which position he now holds.

R. F. SCHWARZ was born near Berlin, Germany, in 1853; educated in Ducal Gymnasi and Ducal College, at Dessau. He came to New York in 1871, removed to Chicago in 1873, and in 1875 bought a farm in Monroe county, in this State, where he has since followed the business of fruit growing and market gardening, devoting at the present time about thirty acres to this pursuit. He was a member of the House of Representatives two terms, 1893 and 1895.

R. S. SEEDS was born in Huntingdon county, Pa., in 1852; was educated in the public schools and at the Shade Gap Academy. He was raised upon a farm and traveled for eighteen years among the farmers, selling agricultural implements. In 1892 he bought a farm that had been run down, which he has greatly improved.

W. H. STOUT was born October 18, 1840, in Lower Nazareth township, Northampton county, Pa.; was educated in the common schools and engaged in various occupations, serving an apprenticeship at coopering and milling, at clerkship and traveling salesman; has lived on his present farm for the past twenty-eight years, and is engaged in general farming, trucking, fruit growing and bee-keeping; has acquired practical and scientific information by observation and study; speaks English and German.

HARVEY ADAM SURFACE, M. S., Economic Zoologist, was born on a farm in Warren county, Ohio, in 1867. He worked on the farm and attended and taught country school. He was educated in the Lebanon (Ohio) Normal, the Ohio State University, the University of Illinois, Hopkins (Stanford) California Seaside Laboratory and Cornell University. He taught in the Ohio State University, the University of the Pacific, Cornell, the Ithaca schools, teachers' institutes and the Pennsylvania State College. He held a fellowship in Cornell and was also appointed Dykman Research Fellow in Columbia University. He was field naturalist for the Illinois State Biological Station and University Extension lecturer in New York. He has also been lecturer in Zoology at the West Coast Chautauqua Assembly and scientific assistant on the United States Fish Commission. He has taught in every known grade of school work, and is noted for his enthusiasm and ability as a teacher, speaker and writer. He is ornithologist of the Pennsylvania State Board of Agriculture, and is making investigations of insects for the Pennsylvania State Department of Agriculture and of fishes for the Pennsylvania State Fish Commission. Among his writings are articles on nature study, zoology, mollusks, insects, fishes, birds, mammals, pedagogy, anatomy, etc. He is nature study editor of the "Popular Educator," ornithological editor of "American Gardening," member of the American Society of Naturalists, American Association for the Advancement of Science, the American Ornithologists' Union, the Pennsylvania State Audobon Society, etc. He makes a specialty of the biologic and economic features of his subjects. He was appointed Economic Zoologist by Governor Pennypacker in 1903, and re-appointed by Governor Stuart in 1907.

DR. I. A. THAYER was born near Warren, Ohio, in November, 1840. He was reared on a farm of which he was foreman for a number of years under a scientific and successful farmer; was graduated in Hiram College, under the presidency of General Garfield. He graduated in medicine in 1866, and practiced that profession several years. Since laying down that practice he has been engaged in public speaking, having, during fifteen years, filled important lecture engagements from Boston to St. Louis, under the management of the leading lyceum bureaus. He has recently finished the course in crop production and that in live stock production in our State College. For nine months in the year his time is given wholly to his farming operations, for years conducting a veritable experiment station, where he has worked with a book in one hand and a hoe in the other; hence, he is equipped with a practical knowledge that he has the ability to express in the clearest manner.

PROF. H. E. VAN NORMAN is a native of Ontario, Canada, and is now 36 years of age. He grew up on farms in Nebraska, Illinois and Michigan, and early became acquainted with pure bred livestock through his father's association with a large importer and exhibitor of Holstein cattle and English draft horses, and by attendance at the old Chicago Fat Stock Show. Was appointed Farm Superintendent at Purdue University Agricultural Experiment Station, Lafayette, Ind.; after four years in this work he was appointed Professor of Dairy Husbandry, Pennsylvania State College of Agriculture, which position he now holds.

F. J. WAGNER was born on a farm near Claridge, Pa., in 1868; received a good common school education and later a course at a business college. Taught public school two terms and since has been regularly engaged in farming, devoting particular attention to dairying and the breeding of fine Jersey cattle. A few years ago he took up the Correspondence Course of the Pennsylvania State College, and has completed the course in Grain, Crops, Clovers, Grapes, Farm Manures and Stock Feeding.

MRS. MARY A. WALLACE is a daughter of the late Chester W. Ballou, Esq., one of the most successful and progressive of the pioneer farmers of Lawrence county, Pa. She was educated in the public schools and Beaver Seminary, Beaver, Pa., and previous to her marriage taught school in her home district. Later, to her household duties, she added newspaper work, and became widely known in literary and journalistic circles through her pen name, "Aunt Patience." Mrs. Wallace was a charter member of the Pittsburg Women's Press Club, and was its treasurer for a number of years. She is also prominent in patriotic societies, and is an honorary member of the One Hundredth Pennsylvania Volunteer (Roundhead) Association. She is in demand as a speaker for Memorial Day.

R. L. WATTS was born at Kerrmoor, Pa., June 5, 1869; raised on the farm of his father, Martin Watts, which farm was largely devoted to fruit culture. Entered Pennsylvania State College in 1887 and graduated from the agricultural course in June, 1890. He was elected assistant instructor in Botany and Horticulture of the University of Tennessee and horticulturist of the Agricultural Experiment Station of this institution in September, 1890. Later he was made Instructor of Horticulture, following by assistant professor of Horticulture and secretary of the Experiment Station. Besides the regular duties as secretary, he has charge of the Farmers' Institutes of the State, held under the auspices of the university and station; he prepared programs, conducted correspondence and participated in the meetings. While at the station he conducted various experiments with fruits and vegetables in the greenhouse and out of doors, the results of which have been published in bulletin form. He wrote Farmers' Bulletin No. 39 on "Onions," for the United States Department of Agriculture. For several years he was editor of the fruit and vegetable department of the "Southern Florist and Gardener;" he is now engaged at the State College.

D. H. WATTS was born near Kerrmoor, Pa., May 25, 1861; was raised on the farm of his father, Martin Watts, and educated in the public schools, which schooling was supplemented by a few months attendance at the Indiana State Normal School. He has always been interested in farmers' organizations and served two years as president of the Clearfield County Agricultural Society. He located upon his farm in 1886 and erected thereon modern buildings and established a dairy plant, where fine butter for a special trade is produced. The growing of fruits is also a specialty. On his farm, known as "Orchard View Farm," there are 3,000 apple, peach, pear and plum trees, all his own selection and planting.

B. H. WAYCHOFF was born and raised on a farm; was educated in public schools, and attended Monongahela College, graduating in the scientific course. Taught several years in public schools; also taught in Monongahela College, in Beaver College and in Beaver High School, and has had considerable experience in public speaking. At the age of twenty-three he bought a poor and almost abandoned farm, and by drainage, liming and raising clover, together with good tillage, it has been brought up to a good degree of productiveness.

W. THEO. WITTMAN, Allentown, Pa., was born and raised on a Lehigh county farm. From boyhood he has been, more particularly, interested in poultry and fruit growing and has made a notable success in both. He is, however, best known as an expert poultryman, beginning in a small way both as a practical and a fancy poultry breeder, making money at both, and holds to-day an enviable reputation as an all-round expert chicken man, being in his element not only as a breeder and judge of the highest grade of poultry, but also well known as an enthusiastic writer and lecturer on his specialty. Being above all intensely practical and never prosy and thus holding a reader or hearer's attention from beginning to end.

WILLIAM HENRY WOLFF, B. S. Agr., was born in St. Georges, Bermuda Islands, December 25, 1880. Entered the regular four-year course in agriculture at the Pennsylvania State College, September, 1902, and completed the course with degree of B. S. Agr., June, 1906. During the last two years of college work specialized in horticulture. Appointed special field assistant to the Economic Zoologist of Pennsylvania during the summer of 1905, Special Orchard Inspector and Demonstrator for Division of Zoology, Department of Agriculture, Harrisburg, August, 1906, to March, 1907. At present is with Hoopes Brothers and Thomas, the Maple Avenue Nursery Company, of West Chester, Pa.

S. PAUL WOODMAN was born on a farm near Rushland, Bucks county, Pa., where he has always lived. He was educated at a common public school, took a three years' course at the George School, near Newtown, Pa. Upon leaving the George School in 1898 he went to work on his father's farm for wages, where he worked until he took entire charge of the farm in 1905. At that time he was taking a correspondence course in agriculture at State College, Pa. He is engaged in general farming, fruit growing and market gardening.

MRS. SARAH BARTRUFF FRITZ ZEIGLER was born near Manheim, Lancaster county. Later moved with her parents to Perry county. Was educated in the public schools, New Bloomfield Academy and Juniata Valley Normal School. Previous to her marriage she taught school six winters. From 1890 to 1902 she manufactured and sold large quantities of jelly to the New York, Philadelphia and Boston markets. Was an active member of Prospect Grange and always held an office in the organization. She has always been deeply interested in agricultural pursuits and since her husband's death has conducted her farm of one hundred and forty (140) acres in an able manner, bringing it up to a high standard of production and adding improvements, believing that pleasant surroundings tend to a better and happier home life.

LIST OF SPECIAL INSTITUTE INSTRUCTORS.

Prof. Alva Agee, State College, Pa.

Dr. H. P. Armsby, State College, Pa.

J. S. Burns, Imperial, Pa., R. F. D. No. 1.

Dr. J. D. Detrich, No. 438 Adams Street, Scranton, Pa.

H. B. Hilton, Port Allegany, Pa.

Dr. Thomas F. Hunt, State College, Pa.

Dr. Louis A. Klein, Deputy State Veterinarian, Dept. of Agriculture, Harrisburg, Pa.

Prof. T. I. Mairs, State College, Pa.
Dr. Carl W. Gay, 36th and Woodland Avenue, Philadelphia, Pa.
Fred. W. Hook, No. 603 Chestnut Street, Lancaster, Pa.
M. S. McDowell, State College, Pa.
Prof. Wm. G. Owens, Lewisburg, Pa.
Mrs. Sara Walrath Lyons, No. 372 Monroe Street, Brooklyn, N. Y.
Prof. J. P. Stewart, State College, Pa.
Prof. H. E. Van Norman, State College, Pa.
Prof. R. L. Watts, State College, Pa.
J. Harry Wolsieffer, Buck Hill Falls, Pa.
Dr. P. J. Mertz, Honeybrook, Pa.
Dr. E. E. Tower, 5414 Osage Ave., Philadelphia, Pa.
Dr. J. W. Sallade, Auburn, Pa.
Dr. C. J. Marshall, 2004 Pine Street, Philadelphia, Pa.
Dr. J. Bryce, Fifth and French Streets, Erie, Pa.
Dr. L. G. Marshall, North Rome, Pa.
Dr. W. D. Fuller, Somerset, Pa.
Dr. J. C. McNeil, 3349 Webster Avenue, Pittsburgh, Pa.
Dr. C. T. Gentner, Malvern, Pa.
Dr. E. S. Deubler, 5413 Norfolk Street, Philadelphia, Pa.
Dr. M. J. Chrisman, 405 Pennsylvania Avenue, Warren, Pa.
Dr. W. A. Haines, Bristol, Pa.
Dr. B. M. Underhill, 3 W. Third Street, Media, Pa.
Dr. M. E. Conard, Westgrove, Pa.
Dr. H. W. Turner, New Hope, Pa
Dr. G. A. Dick, Kane, Pa.
Dr. J. F. Butterfield, So. Montrose, Pa.
Dr. E. M. Michener, North Wales, Pa.
Dr. Geo. B. Jobson, Franklin, Pa.
Dr. E. M. Crawford, 303 Elmira Street, Athens, Pa.
Dr. T. E. Munce, Harrisburg, Pa.
Dr. W. H. Ridge, Trevose, Pa.

DEPARTMENT LECTURERS.

In so far as time and circumstances will permit, the officers of the Department of Agriculture are desirous of engaging in Institute work.

In order to prevent disappointment in the arrangement of programs, it is recommended that Institute Managers first consult the individual whose services they may wish to secure, before placing his name on the program.

Department lecturers come to these Institutes free of charge, except that they are to be taken from and to the railroad station at the expense of the local manager. The topics which they will discuss can be procured by addressing the following officers of the Department of Agriculture:

HON. N. B. CRITCHFIELD, Secretary of Agriculture.
HON. A. L. MARTIN, Deputy Secretary and Director of Institutes.
JAMES FOUST, Dairy and Food Commissioner.
PROF. H. A. SURFACE, Economic Zoologist.
DR. LEONARD PEARSON, State Veterinarian.

CROP REPORT.

The report of Farm Products grown in Pennsylvania continue to show a marked increase in valuation. The market demand has been all that could be desired for cereals, hay and all kinds of livestock, making a grand total of \$341,079,000. The following is a tabulated report of prices received throughout the State:

The following comparison of these tables for the past four years shows an almost uniform advance in the various products of Pennsylvania:

TABLE OF COMPARISON.

	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Wheat, -----	\$0.73	\$0.75	\$1.08	\$0.83	\$0.78	\$0.95	\$0.96	1.10
Corn, -----	.45	.57	.62	.57	.65	.65	.71	.75
Oats, -----	.37	.41	.44	.37	.40	.58	.55	.60
Rye, -----	.53	.60	.70	.63	.61	.73	.76	.77
Buckwheat, -----	.43	.57	.68	.56	.58	.68	.73	.70
Hay, clover, -----	9.43	11.40	10.50	10.00	11.00	11.00	10.50	12.00
Hay, timothy, -----	10.47	14.00	12.00	12.00	13.50	16.50	13.00	15.00
Horses, average, -----	84.00	115.00	120.00	131.00	145.00	148.00	160.00	150.00
Mules, average, -----	77.00	120.00	125.00	139.00	155.00	155.00	160.00	160.00
Cows, average, -----	28.00	38.00	35.00	35.00	38.00	37.00	36.00	38.00
Lambs, average, -----	2.76	3.50	3.50	3.95	4.15	4.25	4.00	4.00
Ewes, average, -----	2.81	3.45	3.50	4.10	4.50	4.75	4.50	4.25
Steers, fat, per pound, -----	.05	.04	.04	.04	.05	.06	.06	.06
Steers, for feeding, per pound, -----	.08	.08	.08	.08	.08	.08	.08	.06
Swine, shoats, per pound, -----	.06	.06	.06	.06	.06	.06	.06	.07
Hogs, fat, per pound, -----	.06	.06	.06	.06	.07	.08	.07	.08
Chickens, dressed, per pound, -----	.11	.14	.13	.15	.15	.15	.14	.18
Chickens, live, per pound, -----	.08	.10	.10	.10	.11	.10	.10	.12
Apples, per bushel, -----	.35	.50	.44	.70	.65	.70	.70	.85
Peaches, per basket, -----	.75	1.15	.82	.90	1.10	1.50	1.20	1.25
Pears, per bushel, -----	.81	.98	.94	.90	.90	1.10	.85	1.10
Plums, per quart, -----	.06	.07	.08	.07	.07	.08	.07	.07
Cherries, per quart, -----	.06	.08	.08	.08	.07	.09	.07	.08
Blackberries, per quart, -----	.07	.07	.08	.07	.07	.08	.07	.09
Raspberries, per quart, -----	.08	.08	.09	.08	.08	.09	.09	.07
Potatoes, per bushel, -----	.50	.58	.52	.59	.60	.70	.80	.70
Butter, per pound, at store, -----	.18	.24	.22	.22	.23	.27	.27	.28
Butter, per pound, at market, -----	.22	.24	.24	.25	.27	.30	.30	.32
Milk, wholesale, per 100 pounds, -----	1.16	1.41	1.50	1.30	1.50	1.50	1.30	1.40
Milk, retail, per quart, -----	.05	.06	.05	.05	.06	.06	.06	.07
Eggs, per dozen, -----	.18	.22	.24	.24	.25	.27	.27	.28
Wool, short, unwashed, -----	.18	.18	.21	.25	.25	.26	.20	.26
Wool, short, washed, -----	.17	.24	.28	.31	.30	.31	.25	.30
Wool, medium, unwashed, -----	.17	.18	.22	.26	.26	.27	.22	.28
Wool, medium, washed, -----	.20	.25	.30	.32	.32	.32	.26	.32
Wool, long, unwashed, -----	.15	.19	.23	.29	.30	.28	.24	.30
Wool, washed, -----	.24	.25	.31	.34	.34	.33	.30	.34
Farm land, improved, value per acre, -----	49.00	56.50	57.00	55.00	60.00	60.00	60.00	60.00

ANNUAL REPORT OF THE

Off. Doc.

OERO REPORT FOR 1900.

of Farm Products and Livestock, with Farm Wages and Board, in Pennsylvania, by Counties. Collected by A. L. Martin, Deputy Secretary of Agriculture.

Cereals.	Hay.											
Counties.												
Wheat, per bushel.	10	10	10	10	10	10	10	10	10	10	10	10
Wheat, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Corn, per bushel.	8	8	8	8	8	8	8	8	8	8	8	8
Corn, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Oats, per bushel.	8	8	8	8	8	8	8	8	8	8	8	8
Oats, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Rye, per bushel.	8	8	8	8	8	8	8	8	8	8	8	8
Rye, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Oats, per bushel.	8	8	8	8	8	8	8	8	8	8	8	8
Oats, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Barley, per bushel.	8	8	8	8	8	8	8	8	8	8	8	8
Barley, estimated yield per acre.	25	25	25	25	25	25	25	25	25	25	25	25
Hay, clover, per ton.	12	12	12	12	12	12	12	12	12	12	12	12
Hay, timothy, per ton.	12	12	12	12	12	12	12	12	12	12	12	12
Hay, timothy, estimated yield per acre.	11	11	11	11	11	11	11	11	11	11	11	11

COBOP REPORT FOR 1900—Continued.

Livestock.

County.

CROP REPORT FOR 1806—Continued.

The following gives the acreage, amount produced and value of Cereals, Potatoes and Hay grown in Pennsylvania; also the number and value of the different Farm Animals, and Pennsylvania's rank among the different states of the Union for the various products enumerated in the year 1906.

CEREALS, HAY AND FARM PRODUCTS.

	Average.	Production.	Average Yield per acre.	Value.	Standing.
Rye,	843,000	5,660,000 bu.	16.8 bu.	\$4,358,000	1
Potatoes,	227,000	19,944,000 bu.	-----	15,956,000	2
Buckwheat,	260,000	4,902,000 bu.	18 bu.	3,744,000	2
Wheat,	1,590,000	29,415,000 bu.	18.5 bu.	29,121,000	6
Corn,	1,450,000	57,275,000 bu.	33.2 bu.	41,811,000	13
Oats,	1,003,000	27,582,000 bu.	-----	15,060,000	10
Hay,	3,118,000	4,677,000 tons.	1.5 tons.	56,124,000	2
Total,	-----	-----	-----	\$166,173,000	-----

FARM ANIMALS.

	Number.	Value.	Standing.
Horses,	619,000	\$71,804,000	12
Mules,	43,000	5,604,000	18
Milch cows,	1,160,000	45,724,000	4
Other cattle,	965,000	17,853,000	15
Sheep,	1,128,000	5,108,000	14
Swine,	900,000	9,515,000	10
Eggs, doz.,	750,000	19,400,000	-----
Total,	-----	\$174,907,000	-----

AGRICULTURAL SOCIETIES.

**LOCAL AGRICULTURAL SOCIETIES, WITH NAMES AND ADDRESSES OF PRESIDENTS AND
ESTARIES, AND DATES FOR HOLDING FALL EXHIBITIONS OF 1905, ETC.**

28

ANNUAL REPORT OF THE

Off. Doc.

Corporate Name of Society.	Name and Address of President.	Name and Address of Secretary.
Horticultural Association of Pennsylvania, Inter-state Picnic Exhibition Association, County Agricultural Association,	Gabriel Heester, Harrisburg, R. H. Thomas, Mechanicsburg, Leonard Rhine, Centre Hall, Arthur Roberts, Gettysburg, D. No. 5.	Edwin C. Tyson, Floradale, H. S. Mohler, Mechanicsburg, D. M. Campbell, Linden Hall, A. I. Welder, Arendtsville,
By County Agricultural Association, Agricultural and Mechanical Association, County Fair Association, County Agricultural Society, County and Horticultural Association of Berks	J. M. Patterson, Imperial, Dr. J. O. Borland, Dayton, Clark Thompson, Hollstown, Dr. F. S. Stater, Bedford, James McGowan, Geiger's Mills, C. D. Herman, Kutztown, Dr. W. Frank Beck, Altoona, W. J. McCabie, Towanda, Liston Bliss, Troy, R. R. Vaughan, Wyallinsburg, G. A. Schaffner, Butler, W. F. Cunningham, Patton, R. F.	J. S. Burns, Imperial, R. F. D. No. 1, C. C. Cochran, Dayton, Allen McDonald, Hookstown, J. Ray Cassina, Bedford, H. Seidel Thron, Reading.
West Fair Association, Fair Association of Blair County, 3rd County Agricultural Society, Agricultural Society, Fair Association, Driving Park and Fair Association, County Agricultural Association, M. County Agricultural Association, County Industrial Society, County Agricultural Exhibiting Co., Bradford Agricultural Association, County Fair Association, M. County Agricultural, Horticultural and Mental Association, Lake Agricultural Association, own Stock Show,	C. D. Hermon, Kutztown, Dr. W. Frank Beck, Altoona, W. J. McCabie, Towanda, Liston Bliss, Troy, R. R. Vaughan, Wyallinsburg, G. A. Schaffner, Butler, W. F. Cunningham, Patton, R. F.	J. B. Eiser, Kutztown, H. S. Werz, Dunmoreville, Bergen Park, Towanda, D. F. Pomery, Troy, G. M. Lyon, Wyallinsburg, W. B. Purvis, Butler.
Franklin Agricultural Association, Franklin Agricultural Association, Franklin University, Dennis Conner, Clarion, Henry Delghmiller, Bloomsburg, H. C. Holcomb, Conneaut Lake, Kirk McCormick, Harrisburg, Vance McCormick, Harrisburg,	F. X. Bumelle, Emporium, Chas. E. Brinkman, Lehighton, John J. Clewlow, Bellefonte, Henry Cope, Lincoln University, Dennis Conner, Clarion, Henry Delghmiller, Bloomsburg, H. C. Holcomb, Conneaut Lake, Kirk McCormick, Harrisburg,	F. G. Judd, Emporium, A. G. Greenawalt, Lehighton, Geo. R. Meek, Belfast, Thomas F. Grier, Oxford, S. S. Laughlin, Clarion, A. N. Yost, Bloomsburg.
Lawrence Agricultural Association, own Fair Association, Agricultural and Horticultural Association, Fair and Driving Park Association, County Agricultural and Manufacturing Society, County Agricultural Society, County Agricultural and Driving Park Association of Cumberland County, own Stock Show,	C. S. Faw, Middletown, Harry Smith, Gratz, J. J. Deardorff, Corry, Dr. John C. Laidley, Carmichaels, M. F. Jamison, Indiana, Samuel Arthurs, Brookville,	Chas. T. Byers, Conneaut Lake, Jas. S. Coble, Mechanicsburg, R. F. D. No. 4, E. Hollis Croll, Middletown, T. S. Klinger, Gratz, Stephen D. Horn, Cory, Geo. L. Pathway, Carmichaels, David Blair, Indiana, J. W. Hartman, Brookville.

Lawata County Agricultural Society,	George W. Boyer, Port Royal,	James N. Groninger, Port Royal.
Chester County Grange Fair Association,	J. D. Yaeger, Aberdeen,	Lionel Winslip, Moscow.
Franklin County Agricultural Fair Association,	F. T. Watt, Lancaster,	I. C. Arnold, No. 53 N. Duke St.,
Adon Valley Fair Association,	GEO. Watson, West Middlesex,	Lancaster.
Adon County Agricultural and Horticultural Association.	W. H. Bolman, Lebanon,	James S. Wood, Pulaski.
Adon County Agricultural Society,	John H. Bennech, Richland,	J. A. Bollman, Lebanon.
Adon Valley Farmers' Club	John W. Eckert, Allentown,	S. P. Hellman, M. D., Hellman Dale.
Adon Central Agricultural Society,	W. A. Ball, Hughesville,	Harry B. Schall, Allentown.
Adon County Agricultural Society,	A. J. McKean, Mercer,	Chas. E. Mosser, Huntington.
Adon County Agricultural Society,	W. H. McIntire, Stoneboro,	W. T. McCoy, Mercer.
Adon County Agricultural Society,	J. S. Williams, Stroudsburg,	Chas. B. Hines, Stoneboro.
Adon County Agricultural Society,	J. H. Stoofelt, Stockertown,	A. F. Everitt, Stroudsburg.
Adon County Agricultural Society,	J. Walter Lovatt, Bethlehem,	J. R. Reinheimer, Nazareth.
Adon County Agricultural Society,	T. H. Butturf, Newport,	H. A. Gorman, Bethlehem.
Adon County Agricultural Society,	G. B. Newbold, Jenkintown,	J. G. F. Stephens, Newport.
Adon Pennsylvania State Fair Association,	Dr. H. Newbold, Jenkintown,	David Rust, Horticultural Hall, Phila.
Adon Pennsylvania State Fair Association,	G. Eugene Brown, Forksville,	M. E. Wilcox, Forksville.
Adon Pennsylvania State Fair Association,	Dr. H. Hoover, Hartford,	H. S. Estabrook, Hartford.
Adon Pennsylvania State Fair Association,	O. W. Brodhead, Montrose,	Selden Munger, Box 544, Montrose.
Adon Pennsylvania State Fair Association,	Frank Strung, Westfield,	J. W. Smith, Westfield.
Adon Pennsylvania State Fair Association,	T. W. Andige, Mansfield,	J. A. Elliott, Mansfield.
Adon Pennsylvania State Fair Association,	E. J. Truttle, Wallisboro,	Herbert Robyer, Wallisboro.
Adon Pennsylvania State Fair Association,	Harry A. Gast, Mifflinburg,	Francis T. Baker, Lewisburg.
Adon Pennsylvania State Fair Association,	John W. Quivey, Washington,	Root, P. Stevenson, Washington.
Adon Pennsylvania State Fair Association,	No. 2, O. H. Cramer, Warren,	R. J. Walt, Sugartrove.
Adon Pennsylvania State Fair Association,	R. M. Wirt, Hanover,	Emerson V. Gammell, Honesdale.
Adon Pennsylvania State Fair Association,	R. M. Wirt, Hanover,	W. G. Holzer, Greensburg.
Adon Pennsylvania State Fair Association,	R. M. Wirt, Hanover,	Edward C.aph York.
Adon Pennsylvania State Fair Association,	R. M. Wirt, Hanover,	M. O. Smith, Hanover.

AND LOCAL AGRICULTURAL SOCIETIES, WITH NAMES AND ADDRESSES OF PRESIDENTS AND
TIES, AND DATES FOR HOLDING FALL EXHIBITIONS OF 1909, ETC.—Continued.

ANNUAL REPORT OF THE

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Corporate Name of Society.	Attendance, 1908.	Base track.	Premiums.	Membership.	Held 1908.	Place.	Date.	Held 1908.
Allegheny County Agricultural Association.	160,000	1 mile.	150	100	6	Williams Grove, --	No fair.	Aug. 30-Sept. 4.
Allegheny County Horticultural Association.	14,000	1 mile.	278	800	6	Grange Park, Centre Hall, --	Sept. 11-17.	Sept. 11-17.
Baldwin Fair Association.	14,000	1 mile.	1,000	-----	-----	-----	-----	-----
Blair County Agricultural Association.	45,000	1 mile.	9	100	9	Imperial, --	Sept. 21-28.	Sept. 21-28.
Blair County Horticultural Association.	40,000	1 mile.	283	800	2,025	Dayton, --	Sept. 22-Oct. 1.	Sept. 22-Oct. 1.
Bucks County Agricultural and Mechanical Association.	20,000	1 mile.	243	688	1,988	Hockessin, --	Sept. 24-30.	Sept. 24-30.
Cambria County Agricultural and Mechanical Association.	75,000	1 mile.	780	1,600	1,600	Bedford, --	Sept. 21-24.	Sept. 21-24.
Cameron County Agricultural and Mechanical Association.	12,000	1 mile.	243	780	1,600	Reading, --	Sept. 28-Oct. 1.	Sept. 28-Oct. 1.
Carroll County Agricultural and Mechanical Association.	18,000	1 mile.	300	100	100	Kutztown, Hollidaysburg, --	Sept. 31-Sept. 3.	Sept. 31-Sept. 3.
Cassadaga Fair Association.	6,000	1 mile.	500	220	220	-----	Sept. 28-Oct. 1.	Sept. 28-Oct. 1.
Centre County Agricultural and Mechanical Association.	45,000	1 mile.	15	100	715	-----	-----	-----
Clarion County Agricultural and Mechanical Association.	12,000	1 mile.	300	750	1,400	Towanda, --	Sept. 28-Oct. 1.	Sept. 28-Oct. 1.
Columbia County Agricultural and Mechanical Association.	6,000	1 mile.	10	250	750	Troy, --	Sept. 14-17.	Sept. 14-17.
Cumberland County Agricultural and Mechanical Association.	45,000	1 mile.	330	158	1,862	Wyalusing, Butler, --	Aug. 31-Sept. 2.	Aug. 31-Sept. 2.
Dickinson County Agricultural and Mechanical Association.	6,000	1 mile.	877	100	610	Carrolltown, --	Sept. 7-10.	Sept. 7-10.
Fayette County Agricultural and Mechanical Association.	6,000	1 mile.	855	500	500	Emporium, --	Sept. 14-17.	Sept. 14-17.

^b County Industrial Society,	15,000	½ mile,	90	465 48	Lehighton, -----	Sept. 28-Oct. 1.
County Agricultural Exhibit-	18,000	½ mile,	10	415 86	Bellefonte, -----	Not decided.
Axford Agricultural Association,	10,000	½ mile,	16	-----	Oxford, -----	Sept. 21-24.
Columbia County Fair Association,	10,000	½ mile,	200	1,000 00	Clarion, -----	Sept. 21-24.
Hopewell County Agricultural, Horti-	10,000	½ mile,	258	1,000 00	Bloomsburg, -----	Oct. 12-15.
Mechanical Association	30,000	½ mile,	258	3,750 77	4,000 00	-----
Lake Agricultural Association	55,000	½ mile,	-----	7,500 00	Conneaut Lake, -----	Aug. 20-Sept. 3.
atural Association of Cumber-	20,000	½ mile,	90	860 00	1, ½ 00	1,000 00
County.	5,000	½ mile,	78	359 10	Carlisle, -----	Sept. 28-Oct. 1.
Town Stock Show	12,000	½ mile,	60	308 00	-----	June 9-10.
Town Fair Association,	10,000	½ mile,	-----	47 00	1,800 00	Hazleton, -----
Agricultural and Horticultural	10,000	½ mile,	368 00	500 00	Middletown, -----	Sept. 7-10.
Elation.	-----	-----	-----	-----	Gartz, -----	Sept. 28-Oct. 1.
Fair and Driving Park Asso-	17,500	½ mile,	98	-----	Corry, -----	Sept. 7-10.
m.	-----	-----	-----	-----	Carmichaels, -----	Sept. 21-24.
County Agricultural and Man-	6,000	½ mile,	140	465 00	3,725 00	-----
turing Society.	40,000	½ mile,	-----	1,000 00	3,000 00	Indiana, -----
County Agricultural Society,	30,000	½ mile,	50	812 00	3,000 00	Brookville, -----
on County Agricultural and	-----	-----	-----	-----	-----	Aug. 31-Sept. 3.
Driving Park Association.	-----	-----	-----	-----	-----	Sept. 14-17.
County Agricultural Society,	42,000	½ mile,	113	568 00	568 00	Port Royal,
Wanna County Grange Fair As-	12,000	½ mile,	49	-----	1,820 55	Madisonville, -----
sociation.	-----	-----	-----	-----	-----	Sept. 21-25.
County Agricultural Fair	-----	½ mile,	-----	-----	-----	-----
lization.	-----	-----	-----	-----	Lancaster, -----	Not decided.
l Fair Association,	15,000	½ mile,	625	883 00	1,800 00	Pulaski, -----
n Valley Fair Association,	50,000	½ mile,	20	612 00	4,000 00	Lebanon, -----
on County Agricultural and	-----	-----	-----	-----	-----	Sept. 14-17.
ultural Association,	-----	-----	-----	-----	-----	Aug. 24-27.
County Agricultural Society,	200,000	½ mile,	897	1,000 00	12,620 75	Allentown, -----
Valley Farmers Club,	6,000	½ mile,	90	568 15	1,413 00	Huntingdon, -----
entral Agricultural Society,	16,000	½ mile,	-----	100 00	1,725 35	Mercer, -----
County Agricultural Society,	30,000	½ mile,	-----	1,000 00	2,100 00	Stoneboro, -----
e County Agricultural Society,	76,000	½ mile,	78	397 00	468 65	Stroudsburg, -----
ington County Agricultural So-	60,000	½ mile,	225	480 00	2,777 40	Nazareth, -----
ylvania State Fair Association,	75,000	½ mile,	-----	-----	-----	Sept. 7-10.
County Agricultural Society,	8,000	½ mile,	-----	-----	2,000 00	Bethlehem, -----
ylvania Horticultural Society,	-----	-----	680 00	680 00	1,100 00	Newport, -----
-----	-----	-----	840	-----	2,100 00	Horticultural Hall, Philadelphia.
County Agricultural Society,	4,300	½ mile,	50	144 00	407 00	Oct. 5-8.
rd Agricultural Society,	3,600	½ mile,	-----	100 00	1,000 00	Forksville, -----
hatta County Agricultural So-	-----	-----	-----	-----	1,200 00	Montrose, -----
isque Valley Agricultural So-	10,000	½ mile,	50	439 44	200 00	Sept. 14-17.
Park Association,	35,000	½ mile,	50	560 56	1,525 48	Sept. 21-24.
-----	-----	-----	-----	-----	8,100 00	Mansfield, -----

LIST OF COUNTY AND LOCAL AGRICULTURAL SOCIETIES, WITH NAMES AND ADDRESSES OF PRESIDENTS AND
SECRETARIES, AND DATES FOR HOLDING FALL EXHIBITIONS OF 1908, ETC.—Continued.

County.	Corporate Name of Society.	Attendance, 1908.	Race track.	Number.	Amount received from State Fund.	Paid, 1908.	Ordered, 1908.	Held 1908.	
								Place.	Date.
Albion, —	Tioga County Pomona Grange, —	9,000.	1 mile,	500	Sept. 29-30.	Wellsboro, —			
Benton, —	Union County Agricultural Society, —	16,000.	1 mile,	200	1,000 00	Lewisburg, —			
Bethel, —	Union Agricultural Association, —	16,000.	1 mile,	1,800	1,477 50	Burgettstown, —			
Benton, —	Warren County Farmers' and Breeders' Association,	—	1 mile,	37	4,381 36	Sept. 28-Oct. 1.			
Benton, —	Wayne County Agricultural Society, —	12,000.	1 mile,	16	50 00	Sept. 28-30.			
Benton, —	Westmoreland Agricultural Society, —	16,000.	1 mile,	100	1,000 00	Not decided.			
Benton, —	York County Agricultural Society, —	180,000.	1 mile,	211	1,000 00	Honesdale, —			
Benton, —	Hanover Agricultural Society, —	46,000.	1 mile,	76	5,339 75	Oct. 4-7.			
Total, —		1,560,000		11,061	21,917 54	Youngwood, —			
					\$85,517 91	Sept. 7-10.			
						Oct. 4-8.			
						Sept. 14-17.			
						Hanover, —			

REPORT OF THE DAIRY AND FOOD COMMISSIONER.

Harrisburg, Pennsylvania, December 31, 1909.

Hon. N. B. Critchfield, Secretary of Agriculture:

Dear Sir: I have the honor to submit herewith the annual report of the Dairy and Food Bureau of the Department of Agriculture for the year ending December 31, 1909. It covers the operations of the year and contains such other details as may be useful for public information.

PRELIMINARY REMARKS.

The year 1909 witnessed a steady advance in popular sentiment favorable to the perfecting of pure food laws and the impartial enforcement thereof. Whereas, not many years ago few thought seriously of the quality of the food products distributed through the retail grocers of the country, it is now the rule for the buyer to scrutinize the quality of the goods offered and to be somewhat careful in making his purchases. The literature on the subject has become so abundant and the consequences of food adulteration have been so vividly depicted by professional gentlemen, that the area of popular intelligence has greatly enlarged. The truth of this statement is not only verified by the rapid multiplication of laws throughout the Union concerning the manufacture and sale of articles going to make up the common food of the people, but also by the vast increase in books, magazine articles and editorial references to the subject. This phase of the matter was mentioned in my last annual report. There has been no diminution of interest upon the part of food journals, trade publications, the weekly and monthly magazines, or the daily press. On the contrary, if there has been any change, it is in the direction of a more vital and a more intelligent concern for the enactment and enforcement of carefully framed provisions regulating the manufacture and the sale of all articles of human consumption.

There never was a period in the history of the United States when its people were more truly alive to the importance of the food problem. This interest is alert and eager and is confined to no particular section; it is wide-spread. It is equally manifest among the wage-earners, the wealthy and those who are moderately well-to-do. Anybody who takes up the study of food and the general attitude of the people of the United States towards its manufacture and sale, will have little difficulty in arriving at a fairly accurate estimate of the extent and the power of this sentiment. Those who feel inclined toward pessimism should remember that less than a generation ago there was little or no sentiment in the direction of oversight in the manufacture or sale of food products. It is true that in the earlier days no urgent necessity for such oversight existed; it is true that changed conditions have had much to do with the creation of public

uneasiness, followed by wide spread agitation, and these brought forth fruit in the shape of the pioneer movements which have developed so satisfactorily in our time and which are destined to still more greatly benefit the consuming public as the years pass. So long as there were no large manufacturing establishments, so long as our cities were small in extent and meagre in population, so long as the average housewife put up her own household supply in the summer or autumn, each supplying the wants of her own family, and possibly some of the nearby neighbors, there was little reason to complain and small fear that greed would work harm to the health of the consumer by the use of decayed or poisoned goods. The growth of population, the cultivation of the commercial spirit, the seizure of opportunities, the keenness of business rivalry, these are some of the things that led to the wholesale adulterations which robbed the consumer of his just due, while endangering his health and shortening his life. And this constant peril became so great at length that the agitation followed which resulted in so decided an improvement in conditions.

UNIFICATION OF STATE AND FEDERAL LAWS.

While this manifest disposition to insist upon the utmost circumspection in the manufacture and sale of food products is evinced by the continual agitation observed in magazine and newspaper articles, as well as in the enactment of new and more efficient legislation by the several state governments, there has likewise grown up a sentiment favorable to the unification of State and Federal laws relating to the preparation and distribution of food products. It is scarcely contended by anyone that the existing National Food and Drugs act is the best obtainable; there is a firm conviction in some quarters that certain of its provisions might be more clearly and more precisely defined, and that a few of the decisions made thereunder, which decisions have all the force of law, should undergo modification. In other words, there should be a disposition upon the part of both State and Federal officials to secure the best possible legislation, looking to the general end sought—the protection of the consuming public from adulterated or counterfeit goods. If the National law is weak in any respect where the State statutes are strong, there should be a willingness to move forward. On the other hand, where State laws are defective and much looser than the Federal act, the State Legislature should be willing to make the needed modifications. This should be done at earliest feasible moment, because it is becoming more and more apparent as the months pass that the utmost efficiency, with the least possible friction, will be attained only when the states and the nation have agreed upon substantially the same provisions. This consummation is not to be brought to pass without more or less hard labor. There must likewise be a disposition to surrender prejudices and to accept compromises which will promote uniformity.

There are many sound and conclusive reasons why the effort to promote uniformity of legislation, as well as of interpretation, should be encouraged by reasonably disposed citizens. One argument that should be carefully considered is, that it would relieve well-disposed manufacturers of food products from many perplexities, considerable trouble and much unnecessary expense, and enable them to serve the people in a far more satisfactory manner than is possible

at present. During the past few years much pure food legislation has been enacted by the several states. Naturally enough, as there was no consultation among the legislators of the several states, and comparatively little communication between food officials concerning this important problein, these several acts are very diverse. This imposes a great hardship upon manufacturers whose business is co-extensive with the Union. They must take special pains to familiarize themselves with the demands and significance of the various acts, as well as with the rules made thereunder by the food commissioners, or other authorities. They find themselves confused by a multiplicity of conflicting laws and rules. A product which may be lawfully sold in one state is contraband in another. While the National government may give an article its paternal blessing, it may be anathama maranatha in the states, or some of them. The consequence is, much vexation of spirit, not only to the manufacturer, but also to the jobber, or to all who have to do with the distribution of the food products of the country. The argument for uniformity seems to be unanswerable. The matter is being widely discussed now and the growing conviction that it will be a happy solution of many National difficulties, as well as a tremendous advantage to the manufacturer will probably become so intense as to lead to appropriate action. I do not believe Pennsylvania will exhibit any spirit of selfishness or any inclination to hold back when the accomplishment of this desirable reform is sought. This is true, in spite of the fact that she is far in advance of most of her sister states in the symmetry and effectiveness of her laws. A recent convention of thoughtful American women declared those laws superior to the Federal statutes, a model which might be profitably imitated by the Federal government.

Desirable as may be the uniformity just suggested, it is not to be looked for in the immediate future. When it is considered that our Union is composed of forty-six separate and independent states, each with its own peculiarities, and that uniformity must come through the individual action of the legislatures of these commonwealths, supplemented by that of the Federal Congress, it will be realized that State uniformity is as yet little more than a pleasant dream, and that the people must continue for the present to depend upon the action of their representatives in the legislatures for the enactment of such laws as will protect them from adulterations, substitution or any other evil thing in the food they eat. So, that while we may labor earnestly to bring about that situation which will be least burdensome and expensive to the manufacturers and wholesalers, we may be sure that for the present the best that can be expect ed is a gradual approach toward the desired situation. Perhaps the reform will be greatly hastened by intelligent and persistent agitation through the newspapers, the magazines and the trade journals.

ACTION OF THE LEGISLATURE OF 1909.

The legislature which convened in January of this year devoted considerable attention to the pure food problem. Six acts became law. The first of these will be known hereafter as the "Pure Food Act, 1909." Its title fully describes the intent of the act: "An act relating to food, providing for the protection of the public health, and the prevention of fraud and deception, by prohibiting the manu-

fature or sale, the offering for sale or exposing for sale, or the having in possession with intent to sell, of adulterated, misbranded, or deleterious foods; prescribing certain duties of the Dairy and Food Commissioner in reference thereto; and providing penalties for the violation thereof." This act was prepared with the purpose of protecting the people of the State from adulterated or misbranded food. To this end its provisions are very sweeping. It is required that any article of food offered in our markets shall be precisely what it is represented to be by the label. It was prepared and enacted upon the theory that consumers are entitled to full knowledge concerning the quality of the goods purchased by them. Thus misbranding is contrary to law. The law is so drawn that the plea, frequently put forward that the foreign substance contained in a certain product is harmless, will no longer avail for the protection of the manufacturer or of the vender, after the latter has been once warned, his guaranty, which is arranged for by the act, protecting him from punishment for the first offence. The act specifically names a large number of chemical and other products frequently used by the manufacturers of food products, which are no longer allowed in Pennsylvania.

The act is the most comprehensive ever enacted in this State. It contains a guaranty clause under the provisions of which the retailer is protected. He must, however, comply with the requirements of the act and procure a proper guaranty from the manufacturer or jobber from whom he purchases his products. Singularly enough, although copies of the act were scattered broadcast, although it was printed verbatim in the Monthly Bulletin of this Bureau, although a special Bulletin was issued and widely distributed containing this and other laws pertaining to the manufacture and distribution of food, and although numerous warnings were written and published in the Monthly Bulletin, a considerable number of grocers failed to avail themselves of the protection offered by the act. The result was that they had neither defence nor protection. It is submitted that when an act of assembly regulating the manufacture and sale of food takes pains to give retail dealers ample and complete protection, the least they can do is to comply with the simple terms prescribed. If they neglect to do so, turning deaf ears to repeated warnings, it is hardly fair to indulge in bitter criticisms of those who have sworn to enforce the law and who must prove true to their oath.

ADULTERATION OF MILK.

Another needed law went into force March 24, having received executive approval on that date. This was the act relating to milk, and providing penalties for the addition of water to milk, or for skimming the butter-fat or any portion thereof therefrom: The act permits the sale of skimmed milk if frankly put on the market as such. No cream is to be sold as cream unless it contains at least 15 per centum of butter-fat. This act was necessary for the reason that some unscrupulous dealers were in the habit of selling skimmed and watered milk for the genuine article. The fact that good milk is essential to the preservation of the health of small children and of invalids, rendered the enactment of such a law quite essential if the State meant to do its duty toward the helpless. By the provisions of Sec-

tion 5 of this act, it in no way affects the act of June 10, 1897, providing against the use of so-called preventives or the act of April 19, 1901, amending the first section of the act of June 10, 1897.

NON-ALCOHOLIC BEVERAGES.

The act regulating the manufacture and sale of non-alcoholic drinks marked an important advance in the attitude of our Commonwealth toward the making and selling of this class of beverages. The absence of any law rendered it quite possible for unscrupulous manufacturers to flood the markets with soft drinks, as they are called, which were well calculated to shorten the lives of consumers. In the tenement quarters of our larger cities, especially during the warm months, venders of penny lemonade and soda water were liberally patronized by children and adults, especially by the former. An analysis of the stuff sold by most of these dealers showed that in many instances the "lemonade" did not contain a trace of lemon, while the soda water was equally devoid of proper and harmless ingredients. The acids contained in these beverages were very injurious to the stomach. The law now on the statute books received the approval of Governor Stuart, March 11, 1909, and strenuous efforts have been made to enforce it. That it was urgently needed was known by all who had given the state of the soft drink market any attention during the last few years. It was not to be expected that those who had formed the habit of poisoning little children for petty gain would abandon the practice at once, but a very great improvement is noticed and there is reason to believe that within a short time all the non-alcoholic beverages sold in the State will be free from dangerous adulterations.

It is to be hoped, now that President Taft has formulated and sent out to the world an official definition of the meaning of the word "whiskey," that the legislature of 1911 will find it a comparatively easy task to frame and enact a proper law for the regulation of the manufacture and sale of alcoholic beverages within the limits of this State. That such legislation is urgently needed is apparent to all who have given the matter careful study. The President's action clears the way for appropriate legislation by the several states of the Union. Our own act should be modeled upon the Federal statute, as interpreted by the President

THE ICE CREAM ACT.

Another important act of the legislature of 1909 was the "Ice Cream Act." This bill was framed with the co-operation of the leading manufacturers of ice cream in the State. It is greatly to the credit

other requirements calculated to protect the public from injury or deception. The act has greatly bettered the conditions surrounding the ice cream trade, and has likewise given consumers a security which was lacking in former years.

TRAFFIC IN DECAYED EGGS.

In my former report allusion was made to the horrible condition of affairs found to exist in Philadelphia in connection with the traffic in ancient or decayed eggs. It will be remembered that certain unscrupulous persons were in the habit of gathering up putrid eggs and selling them to bakers who used them in the manufacture of cakes. It was shown that some of these eggs were in the last stages of putrefaction when examined and that their sale and use in the food of the people constituted a very serious menace to health. In view of the conditions revealed by the investigation undertaken by this Bureau and carried to completion, early in the session, the legislature enacted a law for the protection of the public health, prohibiting the sale of eggs unfit for food. The act is a comprehensive one, so prepared as to meet the conditions existing at the time of the investigation. It was approved by Governor Stuart on the 11th day of March, 1909, and a systematic effort has been made to break up entirely the hideous traffic it was meant to cure. It is certain that the act has been followed by a very decided decrease in the traffic in spoiled eggs, and it is to be hoped the former condition of affairs may never return.

THE LARD ACT.

The persistent intrusion of artificial lard and its sale as the genuine article, made it necessary to prepare and introduce a bill prohibiting deception in the manufacture or sale of lard or any of the substitutes therefor. The bill likewise embraces imitations or lard compounds and provides proper penalties for its violation. The manufacture or sale of such substitutes for genuine lard or of lard compounds is not forbidden. It is provided, however, that they shall contain nothing injurious to health and that the label shall plainly set forth the exact nature of the article exposed for sale.

PUBLICATION OF THE LAWS.

These six acts constitute the body of legislation enacted at the session of 1909, regulating the manufacture and sale of food products and providing for the better protection and the fuller information of the consumer. The purpose has been to drive out of the State all articles containing substances injurious to health, and to compel manufacturers to tell the buyer exactly what sort of an article he is getting. That the year has marked a distinct advance in pure food legislation, cannot be doubted by any person who will take the trouble to compare the present with the not distant past. As already intimated, a special Bulletin was issued containing, not only the newly enacted laws, but also the entire body of laws pertaining to pure food and drinks now on the statute books, together with extracts from import

ant decisions of the courts concerning the meaning and effect of these acts. Many articles were also printed in the Monthly Bulletin concerning the laws and their meaning, and special emphasis was laid on those portions of the new pure food act providing a method whereby the retailer might obtain a guaranty which would secure him immunity from fine or other punishment. New rules and regulations were also prepared and published broadcast, in accordance with the requirements of the act. In short, every effort has been made to instruct retail dealers thoroughly concerning their duties and privileges.

The care taken by the legislature to protect the retailer from indictment and punishment for the sins of the manufacturer, was the result of a conviction among legislators and others that the grocer should not be held responsible for the sins of the manufacturer. Ordinarily the former is not competent to analyze the goods placed on his shelves. Like the consumer, he must take the word of the manufacturer and let it go at that. That he might have no just cause of complaint, the State provides entire immunity for him if he will simply take advantage of the way of escape opened up for his use. I repeat that it is not the fault of the Commonwealth if any grocer is convicted under existing law. In order that conviction may follow, he must ignore the provisions concerning the guaranty or he must persist in selling prohibited goods after having been duly warned by an agent of the Pure Food Bureau. Could anything more be done?

A YEAR OF ACTIVITY.

The year has been one of great activity. Special effort has been made by means of the Bulletin of the Bureau, by personal communications, by explanations by word of mouth, by the circulation of copies of the laws and the rules made thereunder, to educate dealers and consumers to a knowledge of the provisions of the said laws as well as to an interest in their own health and the health of their families and neighbors. The Bureau has been conducted upon the principle that it is better to secure the co-operation of dealers and manufacturers than to invoke the severities of the laws made for the punishment of persistent evil-doers.

The thought has been ever kept, in mind, that the State seeks not the infliction of punishment, but the diffusion of information. No effort has been made to magnify the severity of the law. On the contrary many anxious hours have been devoted to the effort to impress upon the minds of manufacturers, dealers and consumers the central thought, that all should work together for the general welfare. At the same time it has not been forgotten that the law must be magnified in the sight of the people. Those who declined to heed the warnings given from time to time have been called to account, as the records show. It is a source of no particular satisfaction to know that the receipts from fines have been so large; at the same time it is as true now as it was in other days that "the way of the transgressor is hard." He who will not heed the friendly warnings uttered earnestly in his hearing month after month must take the consequence of his own heedlessness or daring.

NO UNNECESSARY PROSECUTIONS.

Acting upon the principle indicated in the foregoing paragraphs, it has not been the policy of the Bureau to overload the courts with prosecutions. No good would be accomplished by piling up business in various counties and congesting the court dockets. The idea has been, rather by means of test cases, to direct the attention of those concerned to the requirements of the various acts of assembly and the necessity of complying with those requirements. It has been thought that the cause of pure food would be best promoted by moderation in respect to matters wherein some uncertainty might be presumed to exist, and whenever it was pretty certain that the decision of a court of justice in one instance would so illuminate the subject as to induce other manufacturers and dealers to resolve to avoid similar violations of the particular act involved. What is sought most earnestly, is the creation of a public sentiment that will insist upon obedience to the acts which have been made into laws for the preservation of the health of the people. It has likewise been considered probable that the large body of good citizens who are engaged in the manufacture or sale of food products have frequently offended in sheer ignorance, and that all they need is information. The illumination furnished by a single case brought to the attention of a prominent court is often sufficient to bring about a new departure by those who furnish the food of the people. There is reason to believe that this policy has produced good results. Here as well as elsewhere, there are exceptions; but they were the rule.

THE SALE OF OLEOMARGARINE.

The sale of oleomargarine or butterine is recognized by the laws of this Commonwealth as entirely legitimate, provided it be conducted under certain well-defined limitations, and in accordance with certain regulations, which experience has taught to be desirable for the protection of the important dairy interests of the State, as well as the consuming public. Our State law forbids the sale of colored oleomargarine under any conditions and requires that oleomargarine or butterine shall be plainly marked as such by the retailer who handles it. This act became law for the reason that many dealers had formed the habit of selling the artificial product as genuine butter. The price was always sufficiently below that asked for real butter to give the counterfeit the preference when the economical buyer was asked to choose between the two. The result was continued deception of the purchaser and material injury to the legitimate butter interests of the State. As a result, the act of May 29, 1901 was placed on the statute books and the Dairy and Food Commissioner instructed to enforce the same. The act is quite extensive, entering into every contingency liable to occur at the time it was enacted, and providing severe punishment for any who violated its provisions. Taken with the Federal act taxing colored oleomargarine ten cents a pound, it was hoped that the practice complained about by the dairymen and farmers would come to an end. This hope has not been justified. The Federal government has had its own troubles with the violators of law who secretly color oleomargarine and put it on the market as genuine butter, thus cheating the government out of its revenue, and cheating

the consumers also into the belief that they were getting real yellow butter, when in fact they were buying oleomargarine which had been colored in unsanitary cellars and filthy stables.

OFFENDERS TRIED AND PUNISHED.

I regret to say that violations of the State law have continued, and that the agents of the Bureau have been compelled to take many offenders into court. In my annual report for 1908, I detailed the conditions which were found to exist in the City of Philadelphia by the agents charged with the protection of the interests of the consumer. It was shown that the men who were engaged in the manufacture of oleomargarine into "genuine yellow butter" were doing their questionable work amid the secrecy and the foulness of cellars and stables, regardless of sanitary conditions, as they were disobedient to the law and careless concerning the lives or the health of their patrons, mindful only of the profits the business brought them. A determined and successful effort was made to break up this nefarious and dangerous business. For the time at least an end was made of it. Several of the worst offenders were arrested, indicted and convicted, receiving punishment bearing some proportion to the magnitude of their offense against the health of their customers and the safety of the city and the surrounding country. Much credit was due the agents who ferreted out the violations of law. Much good was done then.

In this as in other instances, however, eternal vigilance is the price of safety. During the year 1909 the activity of violators of the oleomargarine act was largely transferred to the western part of the State. They were especially busy in Allegheny county, and at last became so bold as to require heroic treatment. The records show that over two hundred prosecutions were successfully terminated in Allegheny county, and that many of the more notorious offenders were heavily fined and sent to prison for a term sufficiently long to give them ample time for reflection and repentance.

AN INTRICATE PROBLEM.

It may be frankly confessed, that one of the most vexatious problems that now confronts the administration of the Dairy and Food Bureau, is the enforcement of the oleomargarine act. The records of the Bureau, hereinafter exhibited, show that there has been no lack of vigilance by its agents in the last few years. Yet the Com-

cally prohibits the sale of colored imitations of butter, no mattter how the coloring may be added. But the judgment of the National government in pronouncing that uncolored which bears a strong resemblance to genuine butter when glanced at hastily by the untrained eye has greatly enhanced the difficulties in the way of convincing violators of the act. The result is a feeling of irritation and bitterness on both sides to the controversy, and it is the unhappy fortune of the Dairy and Food Commissioner to be in the centre of the storm. Nevertheless the figures accompanying this report will show that the interests of the dairyman and farmers have been properly looked after while more fines have been imposed and collected than in any previous year.

CONCERNING THE SALE OF VINEGAR.

It is a great pleasure to be able to report that the condition of affairs existing in other years with special reference to the vinegar imported into the State and sold by many grocers is greatly improved. The cheaper article, misnamed vinegar, which was formerly on sale in many sections of the State—notably in the larger cities, usually contained not a particle of cider, although it was called "genuine cider vinegar." It was composed of dangerous acids and did considerable harm to the unconscious consumer. Many of the dealers sinned ignorantly. Like a goodly proportion of their patrons, they were attracted by the price, which was somewhat lower than that asked for the genuine article. The result was considerable activity in the effort to suppress this dangerous traffic. The vinegar act now upon the statute books of the State was enacted for the benefit of the farmers and fruit growers. It provides a simple and direct way by which the farmers may utilize the surplus apples grown from year to year. It gives them permission to utilize these apples by converting them into cider and then into vinegar. The one clause which provides a penalty for its violation is, that which forbids the addition of water to the juice of the apple. Working under such easy conditions, the farmers of our Commonwealth ought to be able to find a ready market for their surplus apple crop, while at the same time doing a real service to the people of the State by the production of large quantities of genuine vinegar. During the year the situation has improved very greatly so that almost all the vinegar sold by the grocers is the real cider vinegar. It is to be hoped the improvement noted will continue. The quality of the vinegar used in our households is a matter of first class importance.

GENERAL IMPROVEMENT IN CONDITIONS.

An examination of the statistical tables included in this report will show that agents of the Bureau have been industriously engaged during the year in collecting samples of various food products, and that the chemists have carefully gone over these samples analyzing and testing them and reporting results to this Bureau. Altogether 8,530 different samples were collected and subjected to chemical analysis. The result, on the whole, has been quite satisfactory, indicating an upward movement all along the line. It will likewise be perceived that no less than 797 cases were terminated in the various courts of the

Commonwealth in suits brought for violations of the various acts of Assembly relating to food products and the adulteration thereof. Both in the matter of analysis and proceedings in the courts, considerable progress has been made. Of the large number of collections made, extending over almost every article of food brought into the State for sale, a surprisingly small number was adulterated or misbranded, as compared with the condition of affairs in other years. The results of the year's work indicated that manufacturers, generally speaking, are anxious to comply with the requirements of law, and that grocers are equally anxious to serve their patrons with pure and wholesome foods. Toward such a condition of affairs this Bureau has been steadily working during the years of its existence, and it is a great pleasure to believe that the seed sown in other years, and the patient work of the agents and officers of the Bureau have produced such beneficent results. The protection of the public health has been greatly served by the enactment of recent laws. The experience of the past is likely to be of great service in the future.

POLICY CONCERNING PROSECUTIONS.

In the matter of prosecutions, the policy of the Bureau has been to bring just enough under the provisions of the various acts of assembly to convince dealers and manufacturers that the State means business and that the laws must be respected and obeyed. With the exception of the oleomargarine act, no effort has been made to get within the toils every dealer who had carelessly or thoughtlessly violated the revisions of the pure food acts; only those who persisted after ample warning have been proceeded against energetically. The manufacturers of bogus butter have not only violated the State law and deceived the people, but also trampled upon the Federal laws. As for the others, there is reason to believe that most of them erred ignorantly and that they had no desire to offend. As it was, 797 cases were terminated, something more than two a day, a record which shows that the Bureau has not been idle.

When one considers that the courts are usually congested with business and that the Dairy and Food Bureau exists for more vital and enduring purposes than the mere prosecution of offenders, it will be perceived that considerable progress has been made in the direction of educating manufacturers and dealers into the conviction that while the State has no desire to hale anybody into the courts, it will certainly do so if men persist in disregarding the mandates of the statutes which were enacted after careful consideration for the protection of the innocent public. At the same time much useful work has been accomplished in other important directions, and the facts seem to show that it is now only the few who undertake to nullify the provisions of wise laws in order to satisfy their own selfish greed. The work of the year has been unsensational, but it has been fruitful for good in the coming years.

OLEOMARGARINE VERSUS REAL BUTTER.

During the year there was a very decided advance in the cost of the necessities of life. Nor does this tendency to higher cost of living show any tendency to give way to the moderation of former times. Some gentlemen who claim to have devoted much attention to the

problem tell us, that prices will never be as low as they have been; that the era of high prices has come to stay. However that may be, it has produced considerable irritation among the people and led to some natural and inevitable results. The advance in meats, eggs and butter has been especially marked. The soaring prices of butter have tempted the manufacturer of butterine to make extra efforts to introduce their product more extensively than ever before. In many cases this product is now sold openly in the market for precisely what it is. In others it is still called butter and large quantities of it have been sold in the State, as heretofore noted. The increase sale of this substitute for genuine butter has led to considerable irritation among the dairymen, and some of them have felt that they do not have sufficient protection. Here and there it was intimated that this Bureau was not doing its full duty in the matter of enforcement of the laws, although I think the great majority of the manufacturers of butter were convinced that the exact contrary was true.

For the purpose of showing the utter unfairness of the adverse criticism the following comparative table of results was prepared and made public. This was not done from any desire to magnify the work done by this Bureau under its present management, but simply in the interest of truth and justice, and with the desire to acquaint the public with the real facts. The figures are as follows:

COMPARATIVE STATEMENT.

Oleomargarine cases terminated and amount of fines and costs collected under the Act of May 29th, 1901, to and including December 31st, 1909.

Commissioner.	Year.	Cases Terminated.	Fines and Costs Paid to State Treasurer.
Wells & Cope, -----	1901	16	\$1,160 00
Wells & Cope, -----	1902	117	4,118 59
Total, -----		133 Wells & Cope,	\$5,278 59 Wells & Cope.
B. H. Warren, -----	1903	85	\$2,468 55
B. H. Warren, -----	1904	48	1,115 10
B. H. Warren, -----	1905	101	8,300 41
B. H. Warren, -----	1906	118	11,748 44
Total, -----		302 B. H. Warren,	\$23,657 50 B. H. Warren.
James Foust, -----	1907	157	\$14,827 88
James Foust, -----	1908	67	7,199 06
James Foust, -----	1909	273	23,399 35
Total, -----		497 James Foust,...	\$45,326 28 James Foust.

NOTE that during the three years of Commissioner Foust's administration, 497 cases have been terminated as compared with 435 cases terminated during the six years of his predecessors; and that \$45,326.28 in fines and costs has been paid into the State Treasury as compared with \$23,951.00 paid in during the six years of his predecessors.

THE BANE OF THE DAIRYMAN.

In this connection, it is but fair to say, that in every controversy between oleomargarine or any of its variously named products, and genuine butter, it has been the policy of this Bureau to stand with the buttermakers. It is not forgotten that the Federal law recognizes the manufacture of oleomargarine as a lawful occupation, and that the statutes of this State allow the sale of uncolored oleomargarine under certain plainly defined regulations. Whenever the requirements of the State law have been complied with, the legitimacy of the business has been recognized and licenses have been duly issued to dealers in accordance with the provisions of the act. The Dairy and Food Bureau has constantly fought against the introduction and sale of colored oleomargarine, whether under its own name or under the name of yellow butter, and the records of the Bureau show that it has been continuously active. This has been the line of action, not only because it is required by the act of assembly, but also because the Bureau recognizes the value of the dairy industry to the State and the country, and is likewise firmly convinced that a majority of the people prefer to use butter and will use it so long as its price does not bar it from their tables.

The dairymen of this State are among the most useful of its citizens. They are engaged in an occupation which adds to the wealth of the Commonwealth, and which produces an article of diet at once healthful and delicious, not by any means a luxury, but a real necessity. In the prosecution of their work, they are entitled to protection against unfair competition, and it has been my policy to act energetically and effectively against those who have been trying to injure their trade by the introduction of an inferior substitute, especially when that substitute has been sold under the name of genuine yellow butter.

RESULT OF OLEOMARGARINE PROSECUTIONS.

The figures presented in succeeding pages of this report show, that in the prosecution of violators of the oleomargarine act, 273 cases were terminated and \$23,399.35 in fines and costs turned into the State Treasury for the use of the Commonwealth. These figures represent more than twice the sum collected on account of this work in any previous year of the Bureau's existence. A slight survey of the tabular exhibit of the work accomplished and the amounts realized shows that there has been no slackness here. The agents of the Bureau have devoted their attention to this matter with unwearying fidelity, while the various cases have been prosecuted in the courts of the State with an energy and ability that have yielded the happiest results. The successful prosecution of these violators of law and the numerous victories won by the Bureau, must be largely ascribed to the able and courageous efforts of A. H. Woodward, Esq., who represented the legal side of the war against oleomargarine vendors and who has proved himself an expert in this class of litigation. The determination with which these violations of law have been prosecuted and the heavy fines imposed upon some of the chronic violators of the act, ought to have a deterring influence upon those who have hitherto considered it worth their while to set the law at defiance for the purpose of adding to their gains. The suggestion has been made

that the law should be so amended as to forbid the issuance of a license to one who repeatedly offends in this particular. It seems to be a good idea; certainly he who persists in using the privileges granted by the State to injure the public and do violence to law, should be given no consideration by the State.

IMPROVEMENT ALL ALONG THE LINE.

One hundred and seventeen samples of delicacies, including catsups, olive oil, etc., were purchased and subjected to analysis during the year. All of these goods were found to comply with the law in every essential respect, except a number of brands of catsup. These were found to contain an excessive amount of benzoate of soda. Prosecutions were duly instituted and a number of cases terminated. These are reported among the cases terminated under the pure food acts of 1907 and 1909. The improvement in the quality of goods included under this head is extremely gratifying. So far as excess in quantity of benzoate of soda is concerned, this is likely to happen so long as the Federal practice is at variance with that of the Commonwealth. As is generally known, the experts appointed by former President Roosevelt during his term of office to examine and report upon the effect of benzoate of soda upon the human system, came to the conclusion that it was not injurious even in large quantities. Accordingly the Federal food authorities soon after issued an order permitting the use of this preservative without regard to the quantity used in any food product. It was quite certain that many manufacturers would avail themselves of the privilege accorded them and that some would be a bit careless in regard to the quantity put in goods intended for use in states like Pennsylvania where the amount used is limited by law. I am not prepared to advocate the modification of our State law in this respect. There is reason to believe that public sentiment here is very decidedly against the use of such preservatives and would prefer to see the National government advance rather than have the State lower its standards. This seems a reasonable view.

SHOWING OF DAIRY PRODUCTS.

Dairy products made an excellent showing for purity during the year. It is extremely gratifying to be able to report the almost entire exclusion from the markets of this State of impure or adulterated articles in this division of food products. No less than 5,061 samples were purchased and submitted to the chemists for examination and analysis during the year. This included butter, cheese, cream and milk. Of this quantity only 13 samples were found to be adulterated within the meaning of the act of assembly. These were prosecuted, under the law, and the cases duly terminated. Most of these improper samples consisted of milk containing added water. The added substance is in itself harmless and could of itself do no injury to anyone. But when water is added to milk it weakens the strength of the product and in that sense becomes an evil and a menace to the little children who need pure milk of a guaranteed strength in order that they may be properly nourished.

Nor is it any less important for the sake of the sick, the aged or the infirm that the act of assembly forbidding the sale of milk which has been weakened by the addition of water should be rigidly en-

forced. So far as the Bureau has been able to detect violations of the act, the parties guilty of the practice have been promptly brought before the bar of justice and properly punished. In a few cases the butter fat or a portion thereof had been removed, thus impairing the value of the milk. Several of the samples of cream contained less than 15 per cent. of butter fat, the minimum permitted by law. Taken as a whole, however, the results of the examination of these samples show a condition of affairs calling for hearty congratulation. The increased value of the milk and cream now on the market means better health to all along the line and a decrease in the death rate among infants and children.

EXCELLENT CONDITION OF CANNED GOODS.

With the exception of the French peas, which contain salts of copper, and which have been driven out of the State's markets, and mushrooms which were bleached with sulphurous acid, there were no prosecutions for the vending of canned goods in this State. Many samples were procured from various sections of the Commonwealth and all were carefully examined by competent chemists. The result was a clean bill of health for the canners, much to the gratification of the Dairy and Food Bureau. The canned goods purchased and analyzed consisted of tomatoes, corn, peas, beans, fish, potted meats of all kinds, together with a great variety of soups. It is with much satisfaction I bear testimony to the sincere desire of the canners to co-operate heartily and sincerely with the pure food authorities of this State and the country at large. The result of the examinations of the various samples collected by the agents of this Bureau will undoubtedly be as gratifying to the great body of the consuming public as it is to the pure food people and will be to the canners. At one time considerable prejudice had been aroused in the public mind against canned goods. This was the result of bad work by unscrupulous persons who were anxious only to secure quick monetary returns, regardless of the quality of their goods or the effect upon the public health or the public disposition toward canned goods. I am convinced that all this has been remedied. Personally I desire to thank the canners for their quick obedience to the law of the State, and I think I am not going beyond bounds when I recommend their goods to the confidence of the consuming public. They have surely done all that was required of them, and that cheerfully and effectually.

AN IMPORTANT TEST CASE.

The new pure food act, approved May 13th, 1909, prohibits specifically and by name the use of a large number of adulterants. Among the articles thus forbidden is alum. This has been largely employed in the manufacture of baking powders of various brands. According to the plain language of the act, the sale of baking powder wherein

baking powder containing alum, in violation of the provisions of Act No. 292, approved the 13th day of May, 1909." The interests of the Commonwealth, as represented by the Dairy and Food Bureau, were carefully and efficiently looked after by A. H. Woodward, Esq., of Clearfield; Hon. Lyman D. Gilbert, of Harrisburg, and Hon. E. E. Beidelman, also of Harrisburg. These gentlemen most ably represented the people. For the defense appeared Deputy Attorney General Frederick W. Fleitz, of Scranton; Charles H. Bergner, Esq., of Harrisburg and Mr. Barton, of Baltimore. It was contended by the defense that the act prohibiting the use of alum was unconstitutional, and that the particular product used in the baking powder was not really alum. Judge Smith, of Clearfield county, specially presiding, promptly over-ruled both objections and instructed the jury that the act was constitutional and the brand of baking powder under discussion did contain alum, accordingly returned a verdict of guilty in manner and form as indicted. The case is to be removed to the higher courts for final decision. In view of the importance of this case and that a proper presentation of the entire matter from the standpoint of the Dairy and Food Bureau may be preserved for future reference and information, the very interesting brief prepared by the Hon. Lyman D. Gilbert, of counsel for the State, is presented in the form of an appendix to this report. It will be of great value to all seeking information concerning the scope and intent of the act. The paper in which Mr. Barton, of counsel for the defense, presented to the court for the reason advanced in support of the motion to quash the indictment is also given, as well as a copy of the law.

VALUE OF TRADE JOURNALS.

The Bureau has derived much information and profit from a perusal of the various State and city bulletins which it has received from time to time during the year. The increase in these bulletins is a token of the increasing favor with which the people of this country are receiving the pure food propaganda. Great profit has also been derived from a study of the trade journals that have visited the Bureau. These publications are generally favorable to the pure food cause. Here and there one finds an exception to the rule, but the trade publications, taken as a whole, have been singularly fair and open-minded. It might be improper to single out any for special mention. If it were not so I would be glad of the opportunity to specifically express the high favor with which certain of these journals are regarded, the assistance they render us in our work and the very great service they have been doing in helping to educate manufacturers and vendors, not to mention the rank and file, to a better conception of the importance of preventing adulteration of the necessities of life. Many of the leading newspapers of the country have also devoted much space to food discussions during the year, and I am under heavy obligations to the State press for the uniformly kind and courteous treatment accorded this Bureau, its officers and agents. Without the co-operation and sympathy of the trade press and the daily newspapers it would be a difficult matter for any public servant, no matter how well-disposed or how earnest in the discharge of his duty, to accomplish substantial and lasting results. Thanks to

the attitude of the newspapers of Pennsylvania, this State occupies an advanced position in the matter of pure food and the markets are almost entirely empty of adulterated goods.

THE MONTHLY BULLETIN.

The Monthly Bulletin of the Bureau, authorized by law, has appeared regularly during the year. In addition to the usual official statistical reports of the number and localities of oleomargarine licenses and the list of cases terminated in the courts, it contains several pages each month devoted largely to educational work. The specific purpose of the editorial contributions has been to encourage manufacturers to obey National and State laws, to aid grocers in any possible way both in the matter of pleasing patrons and enlarging their numbers and in that of providing nothing but wholesome food products for their customers and to educate housekeepers to watch the labels. In the nature of things there must be more or less sameness about work of this sort, but an effort has been made to deal from month to month with matters of contemporaneous interest. How well this has been accomplished must be left for others to determine. It is something to the Bulletin's credit, however, that many letters have been received during the year from this and other states, commending its tone and complimenting it upon the useful work it is doing. Yet it must be confessed that there are some inattentive readers, since while the rules and regulations have been reprinted several times and many references have been made to the specific requirements of the act under which these rules were framed, some retail dealers got into the toils because they failed to obey said law or to heed the repeated warnings contained in the successive numbers of the Bulletin. It is a pity that so many disregard the admonition to read with attention. On the other hand many do. The letters received from various sources show that the Bulletin has a mission and that the seed it sows does not all fall on barren ground.

RECEIPTS OF THE BUREAU.

All moneys received from oleomargarine licenses, fines or other sources are immediately covered into the State Treasury. No portion of these moneys is used for the maintenance of the Bureau, but the whole is paid over at once to the proper officer. As will be seen by the table of receipts and expenditures, there was received during the year from oleomargarine licenses and from fines the handsome sum of \$86,594.15. From the appropriation made by the legislature of 1909 for the maintenance of the Bureau the sum of \$83,700.68 was expended. Thus it will be seen that the Dairy and Food Bureau of the State Agricultural Department, for the first time in its history, was more than self-sustaining. This is not expected to happen frequently; the fact that it occurred this year is attributable entirely to the

ed in the question of pure food for the people. He has uniformly sustained every action looking toward the protection of the consumer, whether in the enactment of new and more efficient laws or in the enforcement of those already on the statute books.

I renew my expression of repeated indebtedness to the Hon. N. B. Critchfield, Secretary of Agriculture, for the assistance rendered by him during the year. The work of this Bureau, never more intricate than now, has always received his timely aid.

All my assistants in the operations of this Bureau have been faithful and industrious during the year. The agents have conducted themselves in a courteous and considerate manner toward the dealer in food stuffs as well as toward the consuming public in whose interest they have labored. That their labors have not been without good results is attested by the summing up of the work of the year which shows the food market in this Commonwealth supplied with pure and wholesome goods, the impure and the misbranded having been largely eliminated in every department with the exception of oleomargarine and its various products and some articles containing alum. Concerning the latter, it is confidently expected that the coming year will show a very marked advance. The chemists who have analyzed the various samples purchased by the agents and sent them, as well as the attorneys who have represented the Bureau in the various prosecutions instituted or terminated, have done very careful and efficient work and deserve the hearty thanks of the rank and file in whose interest they have labored. Too much credit cannot be given the office force for their faithful work.

The work of the year 1909 has been completed. We look back upon its record, if not with complete satisfaction, at least with the conviction that another step has been taken in the direction of conserving the welfare and promoting the health of the people. We look forward to the future with high confidence, believing that the good already done will be efficiently supplemented by that remaining to be done during the coming months.

Respectfully submitted,

JAMES FOUST,
Dairy and Food Commissioner.



APPENDIX.

SUMMARY.

The following gives a list of articles analyzed by Chemists of this Bureau during the year 1909.

Article.	Number Analyzed.
DAIRY PRODUCTS:	
Butter,	974
Cheese,	8
Cream,	1,078
Milk,	2,906
Milk, skinned,	124
Milk, butter,	8
Milk, condensed,	1
Milk, evaporated,	2
	5,061
OLEOMARGARINE,	
	426
RENOVATED BUTTER,	
	18
EGGS:	
In the shell,	57
Out of the shell,	17
	74
BREAD, CAKES, PUDDINGS, GELATINE, ETC.:	
Bread (loaf),	11
Cake, Coffee,	2
Cake, Cup,	1
Cake, Drop,	3
Cake, Dutch,	2
Cake, Fancy,	1
Cake, Jelly,	1
Cake, Mixed,	6
Cake, Pound,	6
Cake, small and assorted,	8
Cake, Sponge,	6
Cake, no name given,	6
Rolls,	1
Tea buns,	3
Gelatine,	4
Jello,	3
Pudding, fruit flavored,	1
Jellycon,	1
Dried cream	1

SUMMARY—Continued.

Article.	Number Analyzed.
CANNED FRUITS AND VEGETABLES:	
Apricots,	8
Beans, string,	9
Beans, baked,	7
Cherries,	7
Cherries, Maraschino,	15
Corn,	22
Gherkins, sweet and sour,	27
Mince meat,	11
Mixed vegetables,	1
Mushrooms,	11
Olives,	8
Peaches,	7
Peas,	35
Pickled onions,	16
Pickles, cucumber,	76
Pickles, mixed,	12
Pickles, spiced,	6
Pickles, sour,	12
Pickles, sweet,	16
Pineapple,	3
Plums,	1
Rhubarb,	1
Sauerkraut,	1
Tomatoes,	15
Tomato pulp,	9
	<hr/> 329 <hr/> =====
CATSUPS, SALAD DRESSINGS, SAUCES, ETC.:	
Catsup, Tomato,	66
Catsup (no name),	13
Chow Chow,	4
Sauce, Challange,	1
Sauce, Ohili,	3
Sauce, Longfields,	2
Sauce, Worcestershire,	7
Sauce, Oyster and clam,	1
Relish,	4
Salad cream,	9
Salad dressing,	4
Salad dressing and meat sauce,	1
Olive oil,	7
	<hr/> 117 <hr/> =====
FRUIT BUTTERS, JAMS, JELLIES AND PRESERVES:	
Butter, Apple,	3
Butter, Peanut,	6
Jam, Blackberry,	1
Jam, Cherry,	1
Jam, Currant,	1
Jam, Grape,	1
Jam, Peach,	2
Jam, Plum,	2
Jam, Raspberry,	2
Jam, Strawberry,	1
Jam, Strawberry and Apple,	1
Jelly, Apple,	7
Jelly, Apple and Blackberry,	1
Jelly, Crabapple,	1
Jelly, Elderberry and Apple,	1
Jelly, Grape and Apple,	1
Jelly, Raspberry and Apple,	1
Jelly, Pineapple,	1
Jelly, Plum,	1
Jelly (no name given),	2
Preserves, Apple,	1
Preserves, Blackberry,	1
Preserves, Pear,	1

SUMMARY—Continued.

Article.	Number Analyzed.
Preserves, Plum, -----	8
Preserves, Raspberry, -----	1
Preserves, Strawberry, -----	4
Orange Marmalade, -----	1
	49
FLAVORING EXTRACTS:	
Extract, Lemon, -----	1
Extract, Root Beer, -----	1
Extract, Vanilla, -----	5
	7
FRUIT SYRUPS:	
Syrup, Cherry, -----	4
Syrup, Orange, -----	3
Syrup, Orangeade, -----	2
Syrup, Pineapple, -----	4
Syrup, Raspberry, -----	4
Syrup, Strawberry, -----	6
	23
ICE CREAMS:	
Ice Cream, Biscuit, -----	1
Ice Cream, Maple, -----	1
Ice Cream, Chocolate, -----	23
Ice Cream, Peach, -----	9
Ice Cream, Strawberry, -----	21
Ice Cream, Vanilla, -----	136
Ice Cream (no flavor given), -----	43
Milk Balls, -----	1
	227
LARD, -----	222
MEAT EXTRACTS AND SOUPS:	
Extract of Beef, -----	5
Clam Chowder, -----	2
Chicken Soup, -----	2
Tomato Soup, -----	4
Vegetable Soup, -----	3
	15
MEATS AND FISH—CANNED AND FRESH:	
Bacon, Canned, -----	5
Bacon, Fresh, -----	1
Beef, Corned, -----	5
Beef, Dried, -----	6
Beef, Fresh, Canned, -----	

SUMMARY—Continued.

Article.	Number Analyzed.
MEATS AND FISH—CANNED AND FRESH—Continued.	
Corned Cod,	2
Deviled Crabs,	3
Fish, Fresh White,	3
Frankfurts,	13
Ham, Fresh,	1
Ham, Boiled,	1
Ham, Minced,	4
Ham, Potted,	3
Hamburg Steak, Fresh,	87
Herring,	3
Herring Roe,	2
Liver Pudding, Fresh,	1
Lobster, Canned,	3
Mackerel,	1
Meats Potted, Ham Flavor,	3
Oysters, Canned,	11
Oysters, Fresh,	3
Pork Chops,	1
Pork and Beans,	6
Pork, Fresh,	9
Pudding Meat,	2
Salmon, Canned,	13
Salmon, Fresh,	1
Sardines, Canned,	16
Sausage, Fresh,	33
Sausage, Fresh Pork,	96
Sausage, Meat,	8
Sausage, Minced,	2
Sausage, Polish,	7
Sausage, Sliced,	2
Sausage, Summer,	1
Sausage, Vienna,	5
Sausage, Wiener,	36
Shrimps,	6
Tongue,	3
Tongue, Potted,	1
Veal, Fresh,	1
Veal Loaf,	1
	406

NON-ALCOHOLIC DRINKS:

Beerine,	1
Bevo,	1
Birch Beer,	54
Blood Orange,	1
Bo-Lo,	2
Champagne des Pommes,	1
Cider, Apple,	1
Cider, Champagne,	3
Cider, Orange,	2
Cider, Pear,	1
Cider, Sweet,	3
Cherrysip,	2
Coco Cola,	21
Cream Nectar,	2
Cream Brew,	2
Durber,	1
Excallo Grap-one,	1
Ginger Ale,	81
Ginger Beer,	1
Ginger Lithia,	2
Ginger Sparkler,	1
Grapo-Cola,	1
Grape Juice,	108
Grapemist,	4
Hop Ale,	1
Iron Ale,	1
Iron Beer,	1
Iron Brew,	13
Jersey Creme,	4
Lemon Sour,	10
Lime Julee,	1

SUMMARY—Continued.

Article.	Number Analyzed.
NON-ALCOHOLIC DRINKS—Continued.	
Little Dandy,	1
Liquid Force,	28
Malt, Crescent,	1
Malt Extract,	4
Malt Tonic,	1
Malto-Hopo Health Beverage,	1
Moxie,	65
Nectar,	3
Nu-Bru,	5
Orangeade,	8
Orcharade,	3
Peachnlp,	2
Peachmellow,	4
Phosphate, Cherry,	2
Phospho-Brew,	1
Ping Pong,	1
Ple Zee,	1
Pop (no brand given),	30
Pop, Birch,	1
Pop, Black,	1
Pop, Boch,	1
Pop, Brown,	20
Pop, Cherry,	1
Pop, Chocolate,	2
Pop, Cream Soda,	2
Pop, Dark,	10
Pop, Ginger,	1
Pop, Green,	1
Pop, Lemon,	14
Pop, Nectar,	1
Pop, Orange,	9
Pop, Peach,	2
Pop, Pink,	1
Pop, Quince,	1
Pop, Raspberry,	7
Pop, Red,	27
Pop, Strawberry,	36
Pop, Vanilla,	1
Pop, White,	43
Pop, Wintergreen,	1
Pop, Yellow,	1
Proxy,	1
Raspberry Creme,	1
Raspberry Sparkler,	3
Rasport,	1
Real Chocolat,	3
Root Beer,	33
Sarsaparilla,	40
Sarsaparilla, Imitation,	1
Sarsaparilla, Sparkler,	1
Soda, Birch,	1
Soda, Caramel Cream,	1
Soda, Cherry,	4
Soda, Chocolate,	4
Soda, Cream,	25
Soda, Ginger,	2
Soda, Lemon,	22
Soda, Orange,	12
Soda, Peach,	1
Soda, Raspberry,	6

SUMMARY—Continued.

Article.	Number Analyzed.
NON-ALCOHOLIC DRINKS—Continued.	
Water, Mineral,	1
Water, Red Raven Aperient,	3
Water, White Rock Lithia,	3
Weiss Beer,	1
Wild Cherry,	3
Wild Cherry Pepeln,	10
Wina-Vina,	1
	973
SPICES, ETC.:	
Allspice,	2
Cinnamon,	3
Cloves,	1
Ginger,	3
Mustard, Prepared,	6
Pepper, Black,	5
	18
VINEGARS:	
Vinegar, Apple,	3
Vinegar, Cider,	126
Vinegar, Distilled,	3
Syrup,	1
	141
MISCELLANEOUS PRODUCTS:	
Candy,	4
Chewing Gum,	1
Chocolate,	1
Chocolate Syrup,	9
Cocos,	6
Cocoonut, Shredded,	4
Cornflakes,	1
Honey (in comb),	8
Honey (extracted),	3
Jello Ice Cream Powder,	2
Mapleine,	1
Maple Syrup,	1
Noodles,	8
Oats, Crushed,	1
Oats, Rolled,	3
Sugar,	3
Taffy,	3
Cantaloupe (decomposed),	1
	49
RECAPITULATION.	
Butter,	974
Cheese,	8
Cream,	1,078
Milk,	8,001
Oleomargarine,	426
Renovated butter,	18
Eggs,	74
Fruit syrups,	23
Ice cream,	227
Lard,	388
Non-alcoholic drinks,	973
Vinegar,	141
Food,	1,204
Total,	8,580

CASES TERMINATED.

NUMBER OF CASES TERMINATED, AND THE ACT UNDER WHICH PROCEEDINGS WERE INSTITUTED DURING THE YEAR 1909.

Oleomargarine act,	273
Renovated butter act,	6
Meat act,	2
Food act, 1907,	19
Food act, 1909,	110
Milk act, 1901,	14
Milk act, 1909,	112
Lard act,	29
Vinegar act,	45
Non-alcoholic drink act,	148
Ice cream act,	39
<hr/>	
	797

FINANCIAL STATEMENT.

RECEIPTS AND DISBURSEMENTS OF THE DAIRY AND FOOD BUREAU FOR THE YEAR 1909.

RECEIPTS.

Renovated butter licenses,	708 33
Milk fines, act of 1901,	497 00
Renovated butter fines,	391 00
Meat fines,	97 00

	\$86,594 15

DISBURSEMENTS.

Attorneys, detectives and assistants,	\$25,025 96
Chemists and laboratory expenses,	20,005 26
Special agents' salaries,	17,724 00
Traveling and agents' expenses,	15,056 71
Clerical and stenographers,	5,888 75

	\$83,700 68

All the receipts of the Bureau are paid into the State Treasury for the use of the Commonwealth and the Bureau is maintained by an appropriation made by the Legislature.

THE NEW PENNSYLVANIA FOOD LAW, APPROVED MAY 13TH, 1909, TOGETHER WITH CONSTITUTIONAL QUESTIONS RAISED BY RANDOLPH BARTON, JR., ESQ., REPRESENTING THE DEFENSE, AND HON. LYMAN D. GILBERT'S ANSWER THERETO ON THE PART OF THE COMMONWEALTH, IN THE CASE COM. VS. MEYER GROSS.

No. 292.

AN ACT

Relating to food; defining food; providing for the protection of the public health, and the prevention of fraud and deception, by prohibiting the manufacture or sale, the offering for sale or exposing for sale, or the having in possession with intent to sell, of adulterated, misbranded, or deleterious foods; prescribing certain duties of the Dairy and Food Commissioner in reference thereto; and providing penalties for the violation thereof.

Section 1. Be it enacted, &c., That it shall be unlawful for any person, firm, copartnership, limited partnership, joint-stock company, or corporate body, by himself, herself, itself, or themselves, or by his, her, its, or their agents, servants, or employes, to manufacture, sell, offer for sale, expose for sale, or have in possession with intent to sell, any article of food which is adulterated or misbranded within the meaning of this act.

Section 2. That the term "Food," as used in this act, shall include not only every article used for food by man, but also every article used for, or entering into the composition of, or intended for use as an ingredient in the preparation of, food for man.

That the term "Person," as used in this act, shall include individuals, firms, copartnerships, limited partnerships, joint-stock companies, and bodies corporate, as well as all officers, agents, servants, employes, or others acting for any of the same, and shall be taken as applying in the singular or plural as the case may require.

Section 3. That for the purpose of this act, an article of food shall be deemed to be adulterated,—

First. If any substance has been mixed or packed with it, so as to reduce or lower or injuriously affect its quality, strength, or purity.

Second. If any substance has been substituted, wholly or in part, for the article.

Third. If any valuable constituent of the article has been, wholly or in part, abstracted.

Fourth. If it be mixed, colored or changed in color, coated, polished, powdered, stained, or bleached, whereby damage or inferiority is concealed, or so as to deceive or mislead the purchaser; or, if by any means, it is made to appear better or of greater value than it is.

Fifth. If it contains any added sulphurous acid, sulphur dioxide, or sulphites, benzoate acid or benzoates, except as hereafter provided; or if it contains any added boric acid or borates, salicylic acid or salicylates, formaldehyde, hydrofluoric acid or fluorides, fluoborates, fluosilicates, or other fluorine compounds, dulcin, glucin, saccharin, alum, compounds of copper, betanaphthol, hydronaphthol, abrastol, asaprol, oxides of nitrogen, nitrous acid or nitrates, pyroligneous acid, or other added ingredients deleterious to health; or if, in the case of confectionery, it contains any of the substances mentioned in this paragraph, or any mineral substance, or injurious color or flavor, alcoholic liquor, or any other ingredient, not herein mentioned, deleterious to health: Providing, That this act shall not be construed to prohibit the use of harmless colors of any kind, in confectionery, when used for coloring, and not for any fraudulent purpose: And provided further, That nothing in this act shall be construed to prohibit the use of common salt, sugar, pure corn syrup, pure glucose, wine vinegar, cider vinegar, malt vinegar, sugar vinegar, glucose vinegar, distilled vinegar, spices or their essential oils, alcohol (except in confectionery), edible oils, edible fats, wood smoke applied directly as generated, or proper refrigeration: And provided further, That in the manufacture of confectionery the use of alcohol shall be permitted as it may be found in customary alcoholic tinctures or extracts used for flavoring purposes only, and as a solvent for glazes, and that oil of sweet birch, or methyl-salicylic ester, may be used as a substitute for oil of wintergreen as a flavor: And provided further, That in the preparation of dried fruits and molasses, sulphur dioxide, either free or in simple combination, may be used in such quantities as will not render said dried fruits or molasses deleterious to health; and that sodium benzoate may be used in the preparation of those articles of food in which it has heretofore been generally used, in quantities not exceeding one-tenth (1-10) of one per centum, or benzoic acid equivalent thereto: And provided further, That when any quantity of sodium benzoate is used in any article of food, or any quantity of sulphur dioxide is used in the preparation of dried fruits or molasses, the fact that sodium benzoates or sulphur dioxide has been used in the preparation thereof shall be plainly stated on each package of such food.

Sixth. If it consists of, or is manufactured in whole or in part from, a diseased, contaminated, filthy, or decomposed substance, either animal or vegetable; or an animal or vegetable substance produced, stored, transported, or kept in a way or manner that would render the article diseased, contaminated, or unwholesome; or if it is any part of the product of a diseased animal, or the product of an animal that has died otherwise than by slaughter.

Section 4. That for the purpose of this act, an article shall be deemed to be misbranded,—

First. If it be an imitation of, or offered for sale under, the name of another article.

Second. If it be labeled or branded so that it may deceive or mislead the purchaser; or purport to be a foreign product, when not so; or if the contents of the package as originally put up shall have been removed, in whole or in part, and other inferior contents shall have been placed in such package.

Third. If the package containing it, or its label, shall bear any statement, design, or device, regarding the substances or ingredients contained therein, which statement, design, or device shall be false or misleading in any particular.

Fourth. If it be a mixture or compound which may be known, or from time to time hereafter known, as an article of food, unless it be accompanied on the label or brand with a statement that it is a mixture or compound and a statement of the substance entering into said mixture or compound. All labeling of packages required by this act shall be on the main label of each package, and in type not less than eight-point, brevier caps, in size,—unless the size of the package will not permit the use of eight-point cap type, in which case the size of the type may be reduced proportionately,—and in such position and terms as may be plainly seen and read by the purchaser: Provided, That nothing in this act shall be construed as requiring or compelling the proprietors, manufacturers, or sellers of proprietary foods to disclose their trade formulas, except in so far as may be necessary under the provisions of this act to avoid adulteration, imitation, or misbranding.

Section 5. When the Dairy and Food Commissioner, or his agent, shall obtain an article of food, or a sample or portion thereof, from any person, for the purpose of determining whether the same is adulterated or misbranded within the meaning of this act, and it shall be found that the said article of food is adulterated or misbranded within the meaning of this act, then the Dairy and Food Commissioner shall proceed against the said person, from whose store, warehouse, or other place of business said article, sample, or portion thereof, shall have been obtained, for a violation of the provisions of this act.

But no prosecution shall be sustained, under the provisions of this act, against a retail dealer for the selling, offering for sale, exposing for sale, or having in possession with intent to sell, of any adulterated or misbranded article of food, as defined herein, if the retail dealer from whom the said article of food, sample, or portion thereof, was obtained by the Dairy and Food Commissioner or his agent, can establish a guaranty, signed by the manufacturer or wholesale dealer, or jobber or distributor, residing in the United States, from whom such article of food was purchased or procured, to the effect

that the same is not adulterated or misbranded within the meaning of this act designating it.

Said guaranty to afford protection shall contain the name and address of the manufacturer or wholesale dealer, or jobber or distributor, making the sale of such article of food to such retailer, and in such case the said manufacturer or wholesale dealer, or jobber or distributor, so as aforesaid giving such guaranty, shall be amenable to the prosecution, fines and other penalties which would attach, in due course, to the retailer holding such guaranty under the provisions of this act, for a violation hereof; and every manufacturer or wholesale dealer, or jobber or distributor, giving a guaranty under the provisions of this act shall be held responsible, and shall be proceeded against for the adulteration or misbranding of any article of food sold under said guaranty, and shall be subject to the penalties for the violation of the provisions of this act. No such guaranty shall operate as defense to prosecution for violation of the provisions of this act, if the retailer holding such guaranty shall continue to sell the same article of food after written or printed notice from the Dairy and Food Commissioner, or his agent, that such article is adulterated or misbranded within the meaning of this act.

But if said person shall violate the provisions of paragraph six, section three of this act, by having stored or transported or kept said article, in said paragraph mentioned, in a way or manner to render it diseased, contaminated, or unwholesome, said person shall be proceeded against for a violation of the provisions of this act; and it shall not be necessary for conviction that any article, sample, or portion thereof, shall be obtained by the Dairy and Food Commissioner, or his agent, as a condition precedent to prosecution.

Section 6. For the purpose of this act, an article shall be deemed to be the same article,—

First. When it shall be of the same brand, or have thereon the same label, and shall be adulterated or misbranded in the same way.

Second. When it is not labeled or branded, but is sold, offered for sale, or exposed for sale under the same name, and adulterated or misbranded in the same way.

Third. When, although sold, offered for sale, or exposed for sale under another name, or labeled or branded in a different way, it shall be found to be the product of the same manufacturer, grower, or maker, and to be adulterated or misbranded in the same way: Provided, however, That an article shall be deemed to be adulterated in the same way if it shall contain the same adulterant substance or substances.

Section 7. Any person who shall violate any of the provisions of this act shall be guilty of a misdemeanor, and, upon conviction thereof, shall be sentenced to pay a fine of not less than sixty dollars nor

Food Commissioner be paid into the State Treasury, for the use of the Commonwealth.

Section 10. The following acts of Assembly; namely,—an act, entitled "An act to provide against the adulteration of food, and providing for the enforcement thereof," approved the twenty-sixth day of June, Anno Domini one thousand eight hundred and ninety-five;

And an act, entitled "An act for the protection of public health, by prohibiting the manufacture and sale, offering for sale, or having in possession with intent to sell, within the State, of adulterated, misbranded, poisonous, or deleterious foods and confections; regulating the enforcement of the provisions hereof; providing for the protection of persons buying and selling adulterated or misbranded foods and confections under a guaranty; and providing penalties for the violation thereof," approved the first day of June, Anno Domini one thousand nine hundred and seven,—be and the same are hereby repealed.

Provided, nevertheless, That this act shall not apply to, nor in any way affect,—

An act entitled "An act to prohibit the adulteration or coloring of milk and cream by the addition of so-called preservatives or coloring matter, and to provide for the enforcement of the same," approved the tenth day of June, Anno Domini one thousand eight hundred and ninety-seven;

And the amendment thereto, approved the nineteenth day of April, Anno Domini one thousand nine hundred and one, entitled "An act to amend the first section of an act, entitled 'An act to prohibit the adulteration or coloring of milk and cream by the addition of so-called preservatives or coloring matter, and to provide for the enforcement of the same,'" approved the tenth day of June, Anno Domini one thousand eight hundred and ninety-seven;

Nor the act, entitled "An act to prohibit the manufacture and sale of oleomargarine, butterine, and other similar products, when colored in imitation of yellow butter; to provide for license fees to be paid by manufacturers, wholesale and retail dealers, and by proprietors of hotels, restaurants, dining-rooms and boarding-houses, for the manufacture and sale of oleomargarine, butterine, or other similar products, not colored in imitation of yellow butter; and to regulate the manufacture and sale of oleomargarine, butterine, or other similar products, not colored in imitation of yellow butter, and prevent and punish fraud and deception in such manufacture and sale as an imitation butter; and to prescribe penalties and punishment for violations of this act, and the means and the method of procedure for its enforcement, and regulate certain matters of evidence in such procedure," approved the twenty-ninth day of May, Anno Domini one thousand nine hundred and one;

Nor the act, entitled, "An act defining boiled or process butter; designating the name by which it shall be known; providing for the licensing of manufacturers and dealers therein, and regulating the sale and labeling of the same so as to prevent fraud and deception in its sale; providing punishment for violations of this act, the methods of procedure for its enforcement, and certain matters of evidence in such procedure," approved the tenth day of July, Anno Domini one thousand nine hundred and one;

Nor the act, entitled "An act to prohibit the selling, shipping, consigning, offering for sale, exposing for sale, or having in possession with intent to sell, as fresh, any meat, poultry, game, fish, or shell-fish which contains any substance or article possessing a preservative or coloring character or action; making the same a misdemeanor, and to prescribe penalties and punishment for violations, and the means and the methods of procedure for the enforcement thereof," approved the twenty-eighth day of March, Anno Domini one thousand nine hundred and five:

Nor the act, entitled "An act providing for the regulation of the manufacture and sale of distilled and fermented vinegars; prescribing their standard to prevent the adulteration of the same; providing for the enforcement thereof, and punishment for the violation of the same," approved the eighteenth day of June, Anno Domini one thousand eight hundred and ninety-seven;

Nor the amendment thereto approved the twenty-first day of May, Anno Domini one thousand nine hundred and one, entitled "An act to amend the first and second section of an act, entitled 'An act providing for the regulation of the manufacture and sale of distilled and fermented vinegars; prescribing their standard to prevent the adulteration of the same; providing for the enforcement thereof, and the punishment for the violation of the same,' approved the eighteenth day of June, Anno Domini one thousand eight hundred and ninety-seven, so as to provide that vinegar made wholly from grapes, apples, or other fruits shall not be required to contain an acidity of four per centum;"

Nor the act, entitled "An act to prevent fraud and deception in the manufacture and sale of cheese, and defining what shall constitute the various grades of cheese; providing rules and regulations for marketing and branding the same; providing for the enforcement of this act; prescribing penalties for its violation," approved the twenty-third day of June, Anno Domini one thousand eight hundred and ninety-seven;

And the amendment thereto, approved the second day of May, Anno Domini one thousand nine hundred and one, entitled "An act to amend section two of an act, entitled 'An act to prevent fraud and deception in the manufacture and sale of cheese, and defining what shall constitute the various grades of cheese; providing rules and regulations for marking and branding the same; providing for the enforcement of this act; prescribing penalties for its violation,' approved the twenty-third day of June, Anno Domini one thousand eight hundred and ninety-seven,"

Commonwealth
vs.
Myer Gross.

In the Court of Quarter Sessions
of Dauphin County.
No. 61 January Sessions, 1910.
Charge: Selling baking powder
containing alum in violation
of the provisions of Act No.
292, approved the 13th day of
May, 1909.

By Mr. Barton:—

The Court is respectfully requested to quash the indictment on the following ground:

MOTION TO QUASH THE BILL OF INDICTMENT.

To the Honorable, the Judges of said Court:

The defendant, by his counsel, respectfully moves the Court to quash the indictment in this case, being an indictment framed under the Act of Assembly of the State of Pennsylvania, approved May 13, 1909, P. L. 520, for the following reasons:

First. Because said Act is unconstitutional and void.

Second. Because said Act, in so far as it relates to all dealers in food, is unconstitutional and void.

Third. Because said Act, in so far as it relates to all persons who sell, offer for sale, expose for sale or have in their possession with intent to sell food, is unconstitutional and void.

Fourth. That said Act, in so far as it refers to sellers of or dealers in food, is unconstitutional and void, being in conflict with

(a) Section 1, and

(b) Section 9

of Article I of the Constitution of the State of Pennsylvania.

Fifth. That said Act, in so far as it relates to sellers of or dealers in food, is unconstitutional and void, being in conflict with

(a) Paragraph 16,

(b) Paragraph 25, and

(c) Paragraph 27

of the 7th section of Article III of the Constitution of the State of Pennsylvania.

Sixth. That said Act, in so far as it refers to sellers of or dealers in food, is unconstitutional and void, in that it conflicts with the 1st section of the Fourteenth Amendment to the Constitution of the United States.

Seventh. That said Act of Assembly, in so far as it refers to sellers of or dealers in food, is in conflict with the provisions of section one of the Fourteenth Amendment to the Constitution of the United States, in that by the provisions of section five of said Act of Assembly certain privileges, immunities and exemptions are given to certain retail dealers within the jurisdiction of the State of Pennsylvania under certain circumstances, which privileges, immunities and ex-

ception are denied to all other retail dealers within the jurisdiction of the State of Pennsylvania under all circumstances and to all other persons within the jurisdiction of the State of Pennsylvania selling, offering for sale, or exposing for sale food, thus depriving all persons not granted such privileges, immunities and exemptions of the equal protection of the law.

Eighth. That said Act of Assembly does not include within its terms the article Baking Powder as an article of food, said baking powder being the article specified in the indictment as the article of food which had been offered for sale and sold.

Ninth. That said Act is unconstitutional and void because in violation of the Constitution of the State of Pennsylvania, and said Act is unconstitutional and void because in violation of the Constitution of the United States of America.

(Argument.)

By The Court:

Now, 20th of January, 1910, the motion to quash the bill of indictment, having been argued and considered by the Court, for the present purposes of this case, the motion to quash is overruled; the same question can be reached in a motion on arrest of judgment, and the Court is of opinion that it would not be able to pass upon the motion to quash at this time satisfactorily to ourselves.

Commonwealth
vs.
Myer Gross.

In the Court of Quarter Sessions
of Dauphin County.
No. 61 January Sessions, 1910.
Charge: Selling baking powder
containing alum in violation of
the provisions of Act No. 292,
approved the 13th day of May,
1909.

BRIEF FOR COMMONWEALTH.

by

Hon. LYMAN D. GILBERT.

The defendant is charged with violating the provisions of Act No. 292, approved 13th May, 1909, by selling baking powder containing alum.

The Act in question is entitled:

The first section of the Act declares:

"That it shall be unlawful for any person, firm, co-partnership, limited partnership, joint stock company or corporate body, by himself, herself, itself or themselves, or by his, her, its, or their agents, servants or employes, to manufacture, sell, offer for sale, expose for sale or have in possession with intent to sell, any article of food which is adulterated or misbranded within the meaning of this Act."

The second section defines the word "food," and declares that it "shall include not only every article used for food by man, but also every article used for, or entering into the composition of, or intended for use as an ingredient in the preparation of, food for man."

The same section also defines the term "person," as used in the Act and declares that it

"Shall include individuals, firms, co-partnerships, limited partnerships, joint stock companies and bodies corporate, as well as all officers, agents, servants, employes or others acting for any of the same, and shall be taken as applying in the singular or plural, as the case may require."

Section three declares that an article of food shall be deemed adulterated if it contain any added " * * * alum."

The seventh section is in these words:

"Any person who shall violate any of the provisions of this Act shall be guilty of a misdemeanor, and, upon conviction thereof, shall be sentenced to pay a fine of not less than sixty dollars, nor more than one hundred dollars."

It, therefore appears:

That every person is forbidden to manufacture, sell, offer for sale, expose for sale, or have in possession with intent to sell, within this Commonwealth, any article of food which is adulterated."

That "alum" is an adulterated food.

But the defendant contends that, even if he did sell alum, he cannot be punished for its sale, because the Act in question is unconstitutional.

In reply, it may be said:

That the Act in question is a police Act.

This statement will be instinctively accepted by this Court, which so designated the legislation of this Commonwealth to prohibit the sale of oleomargarine, notwithstanding that was a confessedly innocent article of food. The action of this court was affirmed in the case of Powell vs. Commonwealth, 114 Pa. 265, and subsequently affirmed by the Supreme Court of the United States, in 127 U. S., 253.

The Act in question is an exercise of the police power of the State, which may be compactly stated to be the power of self-preservation.

The value placed upon the possession and right to exercise the police power is shown by the language of the Constitution, in Section 3 of Article XVI, which declares that the

"Exercise of the police power of the State shall never be abridged."

The exercise of that power is not abridged even by the Fourteenth Amendment of the Federal Constitution.

This is the language of the Supreme Court of the United States in the case above referred to:

"The present prosecution is founded upon the statute of May 21, 1885; and if that statute be not in conflict with the Constitution of the United States, the judgment of the Supreme Court of Pennsylvania must be affirmed.

"It is contended that the last statute is void, in that it deprives all coming within its provisions of rights of liberty and property without due process of law, and denies to them the equal protection of the laws; rights which are secured by the Fourteenth Amendment of the Constitution of the United States.

"It is scarcely necessary to say that if this statute is a legitimate exercise of the police power of the State for the protection of the health of the people and for the prevention of fraud, it is not inconsistent with that amendment; for it is the settled doctrine of this Court that, as government is organized for the purpose, among others, of preserving the public health and the public morals, it cannot divest itself of the power to provide for this object; and that the Fourteenth Amendment was not designed to interfere with the exercise of that power by the States."

127 U. S., 256.

It is to be noted, in passing, that the question, whether the protection of the people required the entire suppression of the business of manufacturing and selling oleomargarine, rather than its regulation, was declared by the United States Court in that case to be one of fact and public policy, which belongs to the legislative department to determine.

Reference to subsequent affirming decisions is not necessary, because the law, as above stated, continues to be the law of the land.

The unconstitutionality which the defendant claims to have discovered in the Act under which he is indicted must, therefore, be self-inflicted by the Constitution of Pennsylvania.

He undoubtedly seeks refuge under the provisions of Section 7 of Article III, which forbids the Legislature to pass any local or special laws on certain subjects; and his claim must undoubtedly be that the Act in question is not a general but a special law.

Even if we admit, for the purpose of this inquiry, that legislation for the exercise of the police power must be passed in conformity with the requirement of Section 7 of Article III of the Constitution, it is confidently asserted that, even under such limitation, the Act of 13th May, 1909, strictly complies with the constitutional requirements, and is a valid exercise of the legislative power of this Commonwealth.

I. As previously noted, the prohibition of the sale of alum applies to every person within this Commonwealth. The same remark can be made with respect to the doing of any other thing which is forbidden by that Act.

It must be borne in mind that the fact that the Act is universal in its application, applying in its prevention and prohibition to every person, natural or artificial, is the basis of this argument.

For that reason many authorities which have been cited by the defendant have no application in this case.

They construe and interpret statutes which do not include all people, but are only partial in their effect, by reason of exemptions they contain of certain people or classes of people from their operation.

Specific reference to each of those decisions is unnecessary.

The application of the above statement will show that they are without value in determining the question of the constitutionality of this statute.

But it may be asserted by the defendant that the language of this statute of 13th May, 1909, is made unconstitutional by other provisions contained in that Act.

These provisions, to which the defendant specifically refers, are, it is to be assumed, contained in the fifth section, which is in the following language:

"When the Dairy and Food Commissioner, or his agent, shall obtain an article of food, or a sample or portion thereof, from any person, for the purpose of determining whether the same is adulterated or misbranded within the meaning of this act, and it shall be found that the said article of food is adulterated or misbranded within the meaning of this Act, then the Dairy and Food Commissioner shall proceed against the said person, from whose store, warehouse or other place of business said article, sample or portion thereof, shall have been obtained, for a violation of the provisions of this Act.

"But no prosecution shall be sustained, under the provisions of this Act, against a retail dealer for the selling, offering for sale, exposing for sale, or having in possession with intent to sell, of any adulterated or misbranded article of food, as defined herein, if the retail dealer from whom the said article of food, sample, or portion thereof, was obtained by the Dairy and Food Commissioner or his agent, can establish a guaranty, signed by the manufacturer or wholesale dealer, or jobber or distributor, residing in the United States, from whom such article of food was purchased or procured, to the effect that the same is not adulterated or misbranded within the meaning of this Act, designating it.

"Said guaranty to afford protection shall contain the name and address of the manufacturer or wholesale dealer, or jobber or distributor, making the sale of such article of food to such retailer, and in such case the said manufacturer or wholesale dealer, or jobber or distributor, so as aforesaid giving such guaranty, shall be amenable to the prosecution, fines and other penalties which would attach, in due course, to the retailer holding such guaranty under the provisions of this Act, for a violation hereof; and every manufacturer or wholesale dealer, or jobber or distributor, giving a guaranty under the provisions of this Act shall be held responsible, and shall be proceeded against for the adulteration or misbranding of any article of food sold under such guaranty, and shall be subject to the penalties for the violation of the provisions of this Act. No such guaranty shall operate as a defence to prosecution for a violation of the provisions of this Act, if the retailer holding such guaranty shall continue to sell the same article of food after written or printed notice from the Dairy and Food Commissioner, or his agent, that such article is adulterated or misbranded within the meaning of this Act."

"But if said person shall violate the provisions of paragraph six, section three of this Act, by having stored or transported or kept said article, in said paragraph mentioned, in a way or manner to

render it diseased, contaminated or unwholesome, said person shall be proceeded against for a violation of the provisions of this Act; and it shall not be necessary for conviction that any article, sample, or portion thereof, shall be obtained by the Dairy and Food Commissioner, or his agent, as a condition precedent to prosecution."

II. The fifth section does not in any manner authorize any person to manufacture or sell alum, or to do any of the above-described acts, which the other sections of the law make unlawful.

III. It merely regulates the method of the enforcement of that Act.

Let it be remembered that the purpose of the Act is to safeguard the food of the public, and to prevent fraud and deception in the manufacture and sale of food to the public.

The Act would be useless if it did not provide means for prosecuting and detecting the fraud.

The Act now proceeds to select agencies for the detection and prevention of the fraud it condemns.

Its method is this:

(a) Every manufacturer violating this law is made subject to prosecution.

(b) Every wholesale dealer violating this law is made subject to prosecution.

(c) Every retail dealer violating this law is liable to prosecution, unless he has a guaranty

"signed by the manufacturer or wholesale dealer, or jobber or distributor, residing in the United States, from whom such article of food was purchased or procured, to the effect that the same is not adulterated or misbranded within the meaning of this Act, designating it."

But he cannot rely upon such guaranty in the following instances:

1. After certain notice shall have been given him that such article of food is forbidden by this statute. This is stated in that Act in these words:

"No such guaranty shall operate as a defense to prosecution for a violation of the provisions of this Act, if the retailer holding such guaranty shall continue to sell the same article of food after written or printed notice from the Dairy and Food Commissioner, or his agent, that such article is adulterated or misbranded within the meaning of this Act."

2. Said retailer cannot rely upon that guaranty if he shall violate the provisions of paragraph six, section three of the Act,

"By having stored or transported or kept such article, in said paragraph mentioned, in a way or manner to render it diseased, contaminated or unwholesome."

The sixth paragraph of section three is this:

"If it (an article of food) consists of, or is manufactured in whole or in part from, a diseased, contaminated, filthy or decomposed substance, either animal or vegetable; or an animal or vegetable substance produced, stored, transported or kept in a way or manner that would render the article diseased, contaminated, or unwholesome; or if it is any part of the product of a diseased animal, or the product of an animal that has died otherwise than by slaughter."

It is manifest that the thought of the General Assembly in passing, and the Governor in approving, this Act of Assembly, was, so far as is now pertinent, the following:

1. The manufacture, or the sale, or the offering to sell, or exposing for sale, of a food article containing alum was unlawful. No one should be allowed to do any one of these acts.

2. The manufacturer of such an article knows its composition, and shall be held liable for his act in producing such article. Such manufacturing is, if not his sole, at least an important, occupation.

3. The wholesale dealer shall, if he does any of the above-mentioned acts, be liable to the punishment the act provides. In the case of such a person it is to be remembered:

(a) His dealing with the manufacturer is either his chief or his exclusive occupation.

(b) He, next to the manufacturer, is the agent for the distribution of the prohibited articles over large areas.

(c) His business being that of wholesaling, it is to be assumed that he deals directly with the manufacturer. His business is important to the manufacturer, and he probably comes, or can come, into personal or direct relations with the manufacturer, which the retailer cannot do. He has an opportunity of gaining a knowledge of the character of the article thus purchased, which the retailer never has. If he avails himself of his opportunity, he knows the article is prohibited. If he does not avail himself of the opportunity, he neglects his duty, and is liable for its punishment. Standing, as he does, almost on a parity with the manufacturer, he can properly be held, for the purpose of protecting the public health, to have learned, or to have neglected to learn, of the unlawful character of the article that he wholesales. The requirement that he shall, under all circumstances, fully discharge this duty to the public is one upon which the public has the right to insist.

4. The retailer of such an article is always liable for prosecution, except as above seen, in the following instances:

(a) If he can produce a guaranty signed by the manufacturer or wholesaler, or jobber or distributor, residing in the United States, from whom the same was purchased or procured, to the effect that the said article was not adulterated or misbranded within the meaning of the Act.

But the manufacturer or wholesaler, or jobber or distributor, signing such guaranty, must, as above stated, be a resident of the United States.

If such manufacturer, wholesaler, or jobber or distributor is not a resident of the United States, then the guaranty which such retailer has received does not exempt him from prosecution.

This exception applies to all retailers. Its purpose was to substitute for punishment, and to secure the punishment of, the manufacturer or wholesaler, or jobber or distributor, who put in course of distribution the prohibited articles, provided he was amenable to the criminal process of the Court within which the prosecution should be commenced. He would be within that jurisdiction if he were a resident of Pennsylvania. He would be amenable to that jurisdiction if he were a resident of some other state, from which his return to this State could be secured under requisition proceedings.

That such is the intention of the purpose of the statute is shown by this language:

"And in such case the said manufacturer or wholesale dealer, or jobber or distributor, so as aforesaid giving such guaranty, shall be amenable to the prosecution, fines, and other penalties which would attach in due course, to the retailer holding such guaranty under the provisions of this Act, for a violation thereof; and every such manufacturer or wholesale dealer, or jobber or distributor, giving a guaranty under the provisions of this Act shall be held responsible and shall be proceeded against for the adulteration or misbranding of any article of food sold under said guaranty, and shall be subject to the penalties for the violation of the provisions of this Act."

(b) The retailer of such an article is liable to prosecution even if he has such a guaranty, provided he shall continue to sell the same article after written or printed notice shall be given him by the Dairy and Food Commissioner, or his agent, that such article is adulterated within the meaning of the Act in question.

The language of that Act on this subject is this:

"No such guaranty shall operate as a defense to prosecution for a violation of the provisions of this Act, if the retailer holding such guaranty shall continue to sell the same article of food after written or printed notice from the Dairy and Food Commissioner, or his agent, that such article is adulterated or misbranded within the meaning of this Act."

The thought is that if the retailer has actual, or what is equivalent to actual, knowledge that the article in question is adulterated within the prohibition, and sells it, or treats it as an article for sale, he shall be deemed and treated as a violator of this law.

(c) The retailer of such an article is liable to prosecution, if he shall have

"Stored or transported or kept said article, in said paragraph mentioned (in paragraph six of section three), in a way or manner to render it diseased, contaminated or unwholesome * * * ."

In such instance the retailer either negligently or wilfully has added to the unwholesomeness of the article in question, and for that reason has offended against the laws of health, and is held to be a violator of this law.

IV. The law classifies offenders against its provisions.

Its classification is this:

- (a) Manufacturers;
- (b) Wholesale dealers;
- (c) Retail dealers.

If it be contended that the exemption of certain retail dealers coming within the exception above named amounts to further classification, it can, for the sake of this argument, be conceded that there is a sub-classification of retailers into those having and those not having the guaranty above mentioned.

V. Such classification can be lawfully made.

The legislative power to classify, even for purposes of taxation, was vigorously denied soon after the adoption of the present Constitution. But repeated decisions in these prosecutions have affirmed

the right of the legislature to make classification, upon a principle which is thus judiciously stated:

"Classification is a legislative question, subject to judicial revision only so far as to see that it is founded on real distinctions in the subjects classified, and not on artificial or irrelevant ones, used for the purpose of evading the constitutional prohibition. If distinctions are genuine, the Courts cannot declare the classification void, though they may not consider it to be on a sound basis. The test is not wisdom, but good faith in the classification."

Seabolt vs. Comrs. of Northumberland County, 187, Pa., 318.

Wheeler vs. Philadelphia, 77 Pa., 338;

Lloyd vs. Smith, 176 Pa., 213;

In re Sugar Notch Borough, 192 Pa., 349;

Commonwealth vs. Gilligan, 195 Pa., 504.

It may be instructive to note the concluding judicial language of the above decision:

"Undoubtedly many acts have been passed whose framers intended to evade the constitutional prohibitions. These the Courts have always unhesitatingly struck down, and may safely be relied on to continue to do so. But where the legislative intent is not to evade the restriction, the Courts are not required to be astute in extending them over cases not really within the evil prohibited, though the form may have the appearance of coming within the literal words of the Constitution.

* * * * *

"It may, therefore, be taken as settled law that in cases of this character the Courts will look beyond the mere form of the Act, and examine its true intent and affect, in the light of the purpose of the constitutional restriction."

Constitutional classification is, therefore:

- (a) A legislative question;
- (b) Subject to judicial revision;
- (c) But that judicial revision extends only so far as to see that the classification

"Is founded on real distinctions in the subjects classified, and not on artificial or irrelevant ones, used for the purpose of evading the constitutional prohibition."

These things are involved:

- (a) The legislative intent in making the classification must be disclosed by the language of the classification Act.
- (b) The constitutionality of such a classification involves its comparison with matters outside of that statute.

Accepting the above as the true statement of the test to which the question of the constitutionality of a classification Act must be subjected, it is with confidence asserted that the classification made by this Act satisfies every constitutional requirement.

It will be noted that the prohibition contained in the Act in question is against the manufacture or sale of an article of food containing alum.

The only persons who can commit that offense are:

- (a) Manufacturers of the prohibited article; or
- (b) Sellers of that article.

If such an article was not manufactured, there could be no violation of the statute.

If there was no sale of the manufactured article, there would be practically no distribution of the forbidden article.

In order to enforce the provisions of the Act and prevent fraud and deception, it was necessary for the Legislature to devise an effective method of proceeding against manufacturers of such an article and against the sellers.

Manufacturers and sellers of such article are, therefore, the only persons against which the provisions of the Act are directed, and they constitute the only persons who could offend against it.

Therefore, the whole class of offenders is made up of manufacturers and of vendors.

There have been various Acts passed in times predating and succeeding the adoption of the Constitution, which classified all the vendors of articles within this Commonwealth.

Reference has been, and will be, made to the legislation taxing vendors, because it has been declared to embrace all vendors, and its classifications have been decided to be constitutional, as will be hereafter shown. But the reference thus made has been to adopt the classifications thus judiciously sanctioned, in order to select the agencies to reach all vendors of goods, wares and merchandise, in order to prevent the commission of fraud against the provisions of the Act in question.

As already shown,

1. Manufacturers form a complete class;
2. Wholesale dealers form a complete class;
3. Retail dealers are thus sub-classed:

(a) Retailers selling upon guaranty from the manufacturer, wholesaler or jobber;

(b) Retailers selling without such guaranty.

The case of *Norris Bros. vs. Commonwealth*, 27 Pa., 494, involved the construction of the mercantile tax imposed by the Act of April 22, 1846. That Act imposed a tax upon all dealers in American goods, etc., and upon all persons concerned in the manufacture of such goods, etc., who shall *keep a store* for the sale of them, except

"Mechanics who shall keep a store or warehouse at their own shop or manufactory for the purpose of vending their own manufactures exclusively."

This statute sub-classed manufacturers.

This classification ante-dated the present Constitution.

It is to be noted that the statutory meaning is made to follow the popular meaning of the word "dealer."

That case decided that parties manufacturing locomotives and selling them only at their own shop or manufactory are not liable to the mercantile tax imposed upon dealers by the Act of 22d April, 1846.

This case, therefore, exhibits the following:

1. An Act of 1846, taxing:

(a) Dealers as a class;

(b) Sub-classifying manufacturers for taxation purposes.

2. An interpretation of that Act made by the Supreme Court in 1856, recognizing, on popular as well as statutory grounds, these distinct classifications of "dealer" and "manufacturer."

This distinction between dealers and manufacturers is affirmed in *Commonwealth vs. Campbell* 33 Pa., 380.

The case of *Commonwealth vs. Gormly*, 173 Pa., 586, was an appeal from the assessment of a mercantile tax. The Court decided that

"The defendant is neither a manufacturer nor a dealer, in the strict sense of the latter term."

The features of this decision, of present use, are these:

(a) The distinction in classification between dealers and manufacturers is preserved;

(b) The judicial distinction that the defendant was neither a "manufacturer" nor a "dealer," depended, in large degree, upon matters outside of the statute in question;

(c) This decision was rendered in 1896, and the classification it sanctioned could not, therefore, have been unconstitutional.

Many decisions could be cited to prove the constitutionality of such classification.

But they are not separately cited, as the present state of the law is sufficiently declared in the decision of

Knisely vs. Cotterel, 196 Pa., 614.

The subject matter of that decision was the constitutionality of the Act of May 2, 1899.

The Act was entitled:

"An act to provide revenue by imposing a mercantile license tax on vendors or dealers in goods, wares and merchandise, and providing for the collection of said tax."

In its first section, it enacts:

"That from and after the passage of this Act,"

"each retail vendor of or retail dealer"

"in goods, wares and merchandise"

"shall pay an annual mercantile license-tax of one mill additional on each dollar of the whole volume, gross, of business transacted annually."

"Each wholesale vendor of"

"or wholesale dealer in"

"goods, wares and merchandise"

"shall pay an annual mercantile license-tax of three dollars, and all persons so engaged shall pay one-half mill additional on each dollar of the whole volume, gross, of business transacted annually."

"Each dealer in or vendor of goods, wares and merchandise"
"at any exchange or board of trade"
"shall pay a mercantile license-tax of twenty-five cents on each one thousand dollars worth, gross, of goods so sold."

The second section of that Act provided:

"That all persons who shall sell to dealers in or vendors of goods, wares and merchandise, and to no other person or persons, shall be taken, under the provisions of this Act, to be wholesalers; and all other vendors of or dealers in goods, wares and merchandise shall be retailers, and shall pay an annual license-tax as provided in this Act for retailers."

The constitutionality of this Act was contested upon the ground of its lack of uniformity upon the same class of subjects upon which the tax was laid.

This contention was overruled. The tax was sustained upon the ground that it was not specifically on property, but on the business of selling, and the legislative classification was constitutional.

But in passing, it may be remarked that the Court used this language:

"Even regarding it as a tax upon property directly, it could be sustained as a classification according to the use and purposes for which the property is held."

The portion of that decision directly pertinent is this:

"The division of vendors into"
"wholesale"
"and retail"
"is, perhaps, the most obvious and familiar that could be made."
"It is founded on"
"a known or presumed difference in the percentage of profit to bulk of sales,"
"and has been on our statute-books for more than a century."

Note the reason for the division:

(a) A known or presumed difference in the percentage of profit.
There is no statutory mention or reference to such a reason for this division. It is a judicial recognition of matters outside of the statute.

(b) That such division has been on the statute-books for more than a century.

The latter reason is of value as showing that this division of dealers into wholesale and retail was not adopted to escape any provision of the present Constitution.

"It is equally clear that the"

"sub-classification"

"of dealers at an exchange or board of trade"

"is not based merely on location, as complained of, but on the mode of sale. Such dealers are not supposed, in the ordinary course of their business, to carry an actual stock of goods in a store of defined location, with its accompaniment of rent, clerk-hire, expenses of

delivery, etc., but to deal largely, if not entirely, on sample, orders, bills-of-lading, warehouse-receipts, etc., upon which title passes without actually handling goods."

NOTE:

- (a) This is a sub-classification of retailers;
- (b) This sub-classification rests upon the difference in the method in which retailers transact their business;
- (c) The principles governing and justifying such classification are not mentioned in any statute; they are matters of judicial ascertainment and recognition.

"If such differences in the manner of transacting the business exist, they are legitimate basis for classification;"

"and whether they do, in fact, exist is a question for legislative determination."

"We are unable to see that the classification in the Act before us violates the constitutional requirement of uniformity."

In re Registration of Campbell, 197 Pa., 581, the Court uses this language:

"The State may choose its own agents, in its own way, to carry out its commands in regard to the taxing or police or other general powers.

"*Knisely vs. Cotterel*, 196 Pa., 614."

This classification not only does not exceed, but it does not even reach, the limit of constitutional classification. The Act is not only to forbid the manufacture and sale of prohibited articles of food, but to prevent fraud and deception in respect to such food articles.

The Legislature said, if the manufacture can be prohibited, there would be no articles to sell.

It could say to the manufacturer:

- (a) You have made these articles, and have knowledge of their unlawfulness.
- (b) You have made them with the guilty intent of selling them.
- (c) Without your act, the crime against the public health could not have been committed.
- (d) You are the chief offender, and you shall suffer a separate punishment, and that in proportion to your offense.

This legislative classification would certainly have been constitutional. But this increased penalty was not imposed upon manufacturers.

The Legislature, fearing that some manufacturers might violate the law, next considered how the prohibited article of food could be prevented from reaching the public.

Necessarily, the only method of distribution would be through sales. The natural question would be, Do all vendors sell in the same manner?

The answer is that there is a difference between methods of sale, and this distinction has long been observed, and is not only statutory, but popular knowledge.

The wholesale vendors or jobbers the Legislature could have treated as more effective agencies in the distribution, with greater opportunities than retail vendors have for making fraudulent sales.

They have exceptional opportunities to conceal their sales from the Dairy and Food Commissioner, and escape his vigilance.

Clearly, then, wholesale vendors and jobbers could have been separately classified, and for these reasons they could have been more severely punished than retail dealers, whose offenses and chances of escaping detection were comparatively few. But this increased penalty was not imposed upon wholesalers and jobbers.

The only remaining vendors to be considered were retailers. Their classification was imperative, if unlawful sales were to be prohibited.

The Legislature recognizes that they were less harmful agents than either wholesalers or manufacturers in perpetrating fraud and deception upon the public. But, believing that they might be made agencies to help prevent the commission of such offenses against the law, it made, as already shown, this classification of retailers:

(a) Those who assist the Commonwealth to prevent the violation of the law and the perpetration of fraud and deception against it, by revealing the names of such persons as misled them with respect to the nature of the prohibited article, and by furnishing the evidence necessary for the conviction of such persons.

(b) Such retailers who do not offer such aid to the Commonwealth, and whose sales further the distribution to the public of forbidden articles of food.

There is a plain distinction between the actions of such classes of retailers, and if the Commonwealth were required to treat them alike not only would the distinction between innocent and guilty intent be obliterated, but the Commonwealth would be denied the use of an effective agency to prevent the commission of fraud and deception in the sale of prohibited articles.

The Legislature would have been justified in distinguishing between retailers of such diverse conduct, and in inflicting a severer punishment upon those retailers who refuse to assist in enforcing the law, than it did upon such retailers as give such aid.

Before summing this argument, it is proper to direct attention to the case of

Commonwealth vs. Kevin, 202 Pa., 23,

which states the rule of construction to be given to statutes like that one now in question.

The Act there considered was that of June 26, 1895 (P. L. 317).

The title of the Act is:

"An Act to provide against the adulteration of food, and providing for the enforcement thereof."

The decision declares:

"The object of the statute is to protect the public health by securing pure food, and to prevent fraud and deception in the manufacture and sale of adulterated articles of food. The purpose also in the passage of this Act is most commendable, and the statute should receive a construction by the Courts that will fully and effectively accomplish the object of its enactment."

Note this language, that

"The statute should receive a construction by the Courts that will fully and effectively accomplish the object of its enactment."

This effectually disposes of the claim of the defendant that the statute is penal, and, therefore, should be strictly construed.

The judicial decision that it should be construed in such manner that it

"Will fully and effectively accomplish the object of its enactment," is supported by settled principles of law and many affirming opinions.

As was said in *Short vs. Hubbard*, 2 Bing., 349-355,

"There is no impropriety in putting a strict construction on a penal clause and a liberal construction on a remedial clause in the same Act."

The doctrine of qualification of the rule of strict construction is thus stated in Endlich on the Interpretation of Statutes, 337:

"The rule of strict construction, however, whenever invoked, comes attended with qualifications and other rules no less important; and it is by the light which each contributes that the meaning must be determined. Among them is the rule that that sense of the words is to be adopted which best harmonizes with the context, and promotes in the fullest manner the policy and object of the Legislature. It is said that words descriptive of an offense or its punishment, will not be bent on the one side or the other. They are to be construed by reference to the subject-matter, and the context, the apparent policy and the objects of the Legislature; by the whole context, not by a mere division into sections, so as to give effect to the objects and intent of the whole, as well as by a comparison of statutes *in part materia*, and consequently, the old law, the mischief and the remedy. The paramount object, in construing penal as well as other statutes, is to ascertain the legislative intent; and the rule of strict construction is not violated by permitting the words to have their full meaning, or the more extensive of two meanings, when best effectuating the intentions. They are, indeed, frequently taken not in their strict technical sense, if that would defeat, but in a more popular sense, if that will uphold, and carry out, the intention of the Legislature, but in the widest sense, sometimes even in a sense more wide than etymologically belongs or is popularly attached to them, in order to carry out effectually the legislative intent, or, to use Lord Coke's words, to suppress the mischief and advance the remedy. Nor is the rule of strict construction ever violated by permitting the words of a statute to have their full meaning, or by the application of common sense to its terms, in order to avoid an absurdity. They are, therefore, to be held to embrace every case within the mischief, if also fairly within the words read with such corrections as the Court may make to avoid insensibility."

The authorities cited in support of the above statements will, upon examination, be found to demonstrate their correctness.

The modern tendency in the construction of a statute like the one in question is thus stated, in section 339 of Endlich on the Interpretation of Statutes:

"The tendency of modern decisions, upon the whole, is to narrow materially the difference between what is called a strict and a beneficial construction. All statutes are now construed with a more strict regard to the language, and criminal statutes, with a more rational regard to the aim and intention of the Legislature, than formerly. * * * * But it (the rule of strict construction) yields to the paramount rule that every statute is to be expounded according to the intention of them that made it, and that all cases within the mischief aimed at are to be held to fall within its remedial influence."

The authorities sustaining these principles of law are amply stated by the author, and need not here be repeated.

In the distant year of 1843, the rule of construction of a penal statute was thus stated by our Supreme Court:

"But it cannot be maintained that a penal statute is to be construed strictly in all its parts, or that the words of it are to be narrowed in their operation, even in those parts of it which define the offense and annex the penalty. * * * * The true rule is, that words descriptive of an offense, or the punishment of it, are not to be bent to the one side or the other."

Per Gibson, C. J., the Mayor *vs.* Davis, 6 W. & S., 269-277.

The present state of the law, as above mentioned, is this:

"It is, however, the object of the construction of penal as of all other statutes, to ascertain the true legislative intent; and while the Courts will not, on the one hand, apply such statutes to cases which are not within the obvious meaning of the language employed by the Legislature, even though they may be within the mischief intended to be remedied, they will not, on the other hand, apply the rule of strict construction with such technicality as to defeat the purpose of ascertaining the true meaning and intent of the statute."

26 A. & E. Enc. L., 2d ed., 659.

What this argument thus far proves may thus be stated:

1. It is a police statute to provide for the protection of the public health and the prevention of fraud and deception in the manufacture or sale of various food articles, including those containing alum.
2. The legislative purpose in passing this Act
"is most commendable, and the statute should receive a construction by the Courts that will fully and effectively accomplish the object of the enactment."

That, it is respectfully suggested, means this:

3. In order to make that prohibition effective and that protection complete, it was necessary to stop the manufacture and sale of such prohibited articles, and, therefore, it made certain classifications.

These were:

- (a) Manufacturers;
 - (b) Wholesalers;
 - (c) Retailers, sub-classifying dealers into those selling and those not selling upon written guaranty made to them by those who had sold them the articles in question.
4. The classification of manufacturers is constitutional.
5. The classification of wholesalers is constitutional.
6. The classification of retailers is constitutional.
7. A sub-classification of manufacturers is legal. This classification rests upon the difference in manner in which the manufacturers vend their wares.
8. A sub-classification of retailers is constitutional, resting upon a difference in their method of selling their wares.
9. To each member of the sub-classification of retailers who sell without a written guaranty the right is given to pass into the other sub-classification of retailers, by merely requiring such guaranties to accompany or precede their purchase of the articles in question.
10. That such classifications antedated the adoption of the present Constitution, and were not only not made to evade its provisions, but were adopted solely as the best method, in the legislative judgment, of insuring to all the citizens of this Commonwealth protection against the crime of selling articles of food which the Legislature declared to be injurious to public use.

11. That such classifications were adopted in the present Act, not for the purpose of discriminating against, or in favor of, any citizen or citizens of this Commonwealth, but because they were divisions of all vendors of goods, wares and merchandise in this Commonwealth, and included every vendor of any of said articles.

It has been contended on behalf of the defendant that the doctrine of classification practically applies to no subject-matter except that of taxation.

It is sufficient to say that this statement overlooks, and is overthrown by, the fact that classification has been sanctioned in the following instances, all of which are governmental in their character:

- (a) Cities;
- (b) Counties;
- (c) Boroughs;
- (d) Townships.

Citations of statute-law and of judicial decisions are alike unnecessary to prove the correctness of the above statement. Its truth is well known.

It has been orally contended by the defendant that such classification has been made unconstitutional by the Fourteenth Amendment to the Constitution.

In support of that numerous authorities have been cited. But as the representative one is that of *Connolly vs. Union Sewer Pipe Co.*, 184 U. S., 679, its consideration will afford sufficient reply to this branch of the argument of the defendant.

The pertinent part of that decision is this:

"A State may, in its wisdom, classify property for purposes of taxation, and the exercise of its discretion is not to be questioned in the United States Court, so long as the classification does not invade rights secured by the Constitution of the United States. But different considerations control when a State, by legislation, seeks to regulate the enjoyment of rights and the pursuits of callings connected with domestic trade. In prescribing regulations for the conduct of trade it cannot divide those engaged in trade into classes and make criminals of one class if they do certain forbidden things, while allowing another favored class engaged in the same domestic trade to do the same things with impunity. It is one thing to exercise the power of taxation so as to meet the expense of government, and at the same time indirectly to build up or protect particular interests or industries. It is quite a different thing for a State, under its general police power, to enter the domain of trade or commerce, and discriminate against some by declaring that particular classes within its jurisdiction shall be exempt from the operation of a general statute, making it criminal to do certain things connected with domestic trade or commerce. Such a statute is not a legitimate exertion of the power of classification, rests upon no reasonable basis, is purely arbitrary, and plainly denies the equal protection of the laws to those against whom it discriminates."

This quotation states with the utmost possible strength the fullest contention of the defendant in this respect.

The complete answer to that is this:

The sale of the articles prohibited by the law in question is absolute and universal. Every person is forbidden, and no person is permitted, to make any such sale.

The classification is adopted merely to secure the full and complete enforcement of the Act.

The difficulties of detecting violators of the law were self-evident to the Legislature, and, therefore, its treatment of the retailer was for the sole purpose of acquiring information which would enable it effectively to discover and prevent the manufacture and sale of the prohibited articles.

Nowhere is it declared lawful for any retailer to make a sale which any manufacturer or other dealer is prohibited from making.

The law merely said to a retailer, if you bought from a vendor, and if you sought to comply with the law by requiring your vendor to give you a written guaranty that the article he sold you complied with legal requirements, and that vendor lives within the United States, and you will disclose his name and surrender the guaranty so that he can be prosecuted for the offense which he induced you to commit, you shall not be punished for your first offense against the law.

This is placing a premium upon confession; not for the purpose of exempting any person as a criminal, but to secure a more effectual compliance on the part of all the citizens of this Commonwealth with the requirements of this law, and thus prevent the manufacture and sale of unwholesome articles of food.

The premium, if such it could be called, given to a retailer was conditioned solely upon his disclosure of the name of his vendor, and, as observed, it thereupon became official duty to prosecute that vendor. If that vendor did not reside within the United States, and was thereby exempt from prosecution, the disclosure of his name by the retailer was of no avail to the retailer.

That the classification made by the Act in question is not unconstitutional, is shown by the following decisions of the Supreme Court of the United States:

The case of *Barbier vs. Connolly*, 113 U. S., presented the following facts:

The Board of Supervisors of the city and county of San Francisco passed an ordinance reciting that the establishment of public laundries and wash-houses, where clothes and other articles were cleansed for hire, endangered the public health and safety, prejudiced the well-being and comfort of the community, and destroyed the value of property in the neighborhood.

The ordinance was penal in its nature, and declared, among other things,

"that after its passage it shall be unlawful for any person to establish, maintain or carry on the business of a public laundry or of a public wash-house within certain designated limits of the city and county, without first having obtained a certificate signed by the health-officer of the municipality that the premises were properly and sufficiently drained, and that all proper arrangements were made to carry on the business without injury to the sanitary condition of the neighborhood; also a certificate signed by the Board of Firewardens of the municipality that the stoves, washing and drying apparatus and the appliances for heating smoothing-irons were in good condition, and that their use was not dangerous to the surrounding property from fire, and that all proper precautions were taken to comply with the provisions of the ordinance defining the fire limits of the city and county and making regulations concerning the erection and use of buildings therein.

It will be noted that this legislation made the business of carrying on public laundries and wash-houses illegal only within certain limits of the city of San Francisco.

It was claimed that this ordinance violated the Fourteenth Amendment of the Constitution of the United States and certain sections of the Constitution of the State of California.

The Supreme Court of the United States upheld this legislation.

In the case of *Hing vs. Crowley*, 113 U. S., 703, the Supreme Court of the United States considered an ordinance of the city and county of San Francisco, which, in its main features, resembled that considered in the above case of *Barbier vs. Connolly*.

The Court declared that

"the provision for the cessation of labor in the laundries within certain prescribed limits of the city and county during certain hours is purely a police regulation * * *"

The plaintiff offered the additional objection to the constitutionality of this legislation, that it discriminated between different classes engaged in the same business.

That contention and its result are thus stated:

"But counsel in the Court below not only objected to the fourth section of the ordinance as discriminating between those engaged in the laundry business and those engaged in other business, but also as discriminating between different classes engaged in the laundry business itself. This latter ground of objection becomes intelligible only by reference to his brief, in which we are informed that the laundry business, besides the washing and ironing of clothes, involves the fluting, polishing, blueing and wringing of them; and that these are all different branches, requiring separate and skilled workmen, who are not prohibited from working during the hours of night. This fluting, polishing, blueing and wringing of clothes, it seems to us, are incidents of the general business, and are embraced within its prohibition. But if not incidents, and they are outside of the prohibition, it is because there is not the danger from them which would arise from the continuous fires required in washing; and it is not discriminating legislation in any invidious sense that branches of the same business from which danger is apprehended are prohibited during certain hours of the night, whilst other branches involving no such danger are permitted."

These decisions have been so frequently affirmed that their authority is free from doubt or question.

They establish these propositions of law:

(1) That the conduct of a certain kind of business can be made unlawful within a certain portion of a municipality within certain hours, while the conduct of the same kind of business in other portions of the same municipality is lawful.

(2) "That branches of the same business from which danger is apprehended are prohibited during certain hours of the night, whilst other branches involving no such danger are permitted."

The distinction which the Act in question makes between different branches of the same business does not violate the Fourteenth Amendment of the Federal Constitution.

It is further alleged on behalf of the defendant that the classification is open to this objection:

That the retailer is not protected even by a guaranty, unless he be the retailer from whom the Dairy and Food Commissioner, or his agent, purchased the prohibited articles.

The answer to that is twofold:

1. Section five is the only portion of the Act on the subject of guaranty which the retailer can produce to obtain his immunity from prosecution for the first offense. Even if such immunity, upon such conditions and for such purposes, were unconstitutional, the entire section could be omitted, and the Act be operative, and, therefore, constitutional, even under the claim of the defendant. The

remaining sections of the Act contain the prohibition, declare the offense and provide the punishment, without requiring the assistance of its fifth section.

2. This argument of the defendant not only fails to refer to, but entirely overlooks, the following sections of the Act:

"Section 8. The Dairy and Food Commissioner of the State shall be charged with the enforcement of the provisions of this Act, and shall make rules and regulations for the proper enforcement thereof, and shall cause such rules and regulations to be published in the official bulletin in the issue immediately following the preparation of the same.

"Section 9. All fines and penalties imposed and recovered for the violation of any of the provisions of this Act shall be paid to the Dairy and Food Commissioner, or his agent, and by the Dairy and Food Commissioner be paid into the State Treasury, for the use of the Commonwealth."

The power of enforcing that statute, and, therefore, of commencing the prosecutions thereunder, is entrusted to the Dairy and Food Commissioner.

In his Department and for the discharge of his official duties, he has no greater power than is committed to any of the following officers:

- (a) The Attorney General;
- (b) The Auditor General;
- (c) The Secretary of Internal Affairs;
- (d) The State Live-Stock Sanitary Board, under the Acts of 1895 and 1897;
- (e) The Factory Inspector, under the Act of June 3, 1893 (P. L. 277), and the Act of May 29, 1901 (P. L. 325);
- (f) Mine Inspectors, under the provisions of the Act of 15th May, 1893 (P. L. 71), which is the Bituminous Mine Act, and also to Anthracite Mine Inspectors, under the Act 2d June, 1891 (P. L. 190);
- (g) Also to the Dairy and Food Commissioner, under the Act of 1st June, 1907 (P. L. 386).

This latter Act was referred to with approbation by the counsel for the defendant, who stated that its provisions should have appeared in the Act in question, with the exception of that feature upon which it was declared unconstitutional.

The unconstitutional feature was that the Act attempted, by mere reference to title, to include within its provisions the provisions of the National Food and Drugs Act, and rules and regulations thereof.

The examination of that Act shows that prosecution could not have been commenced by any person other than the Dairy and Food Commissioner.

The defendant orally insisted that to commit to the Dairy and Food Commissioner the power to enforce this Act, and, therefore, to be the person to commence prosecutions for its violation, made the Act unconstitutional, because it was in violation of the Fourteenth Amendment of the Federal Constitution.

The answer to that is this:

It certainly is within legislative power to create the office of Judge, to be filled by a single person. The occupant of that office will then be the only person to whom the right of trial is committed.

The Legislature certainly has the right to create the office of a magistrate, who shall have the right to hear criminal prosecutions, which other citizens do not enjoy.

It certainly has the right to create District Attorneys, and give to them the sole power to try criminal cases.

This is merely the selection of agencies for administering government. Their creation does not in any manner infringe the rights of other citizens, although other citizens are not allowed to discharge the duties of such officials.

It is true, the Dairy and Food Commissioner might not fully discharge his official duties. But the other officials, just mentioned, might fail in the same manner.

Responsibility for conducting human government must be lodged somewhere, even though at times official duties are not legally performed.

This argument would absolutely destroy the method of administering the duties of the Auditor General and other State officials to which specific reference has been made, and reduce the power of the people of Pennsylvania to create and select their own officers for the administration of their affairs to such an extent that they would be practically powerless to protect themselves and conduct their government.

It is well known that an investigation of the character of food manufactured, or manufactured and sold, is complicated, and an expensive one. The burden properly rests upon the Commonwealth to prove that the suspected article is an unlawful one. To make that proof, expensive agencies must be employed. Chemists of note and ability must be secured, who will not only satisfy themselves that the article is unlawful before proceedings are commenced against its manufacturer or seller, but also be able to encounter the numerous chemists which large manufacturing and selling interests are able to employ, and convince a jury that a crime has really been committed. It is also due the manufacturer and seller that such proceedings should not be commenced against him until scientific and legal testimony has been secured to show his actual guilt.

If the enforcement of this law were not left to an officer of the Commonwealth, it would, for the reasons above stated, either not be enforced, or manufacturers and sellers would be harassed and annoyed by suits commenced against them by irresponsible parties, for possibly doubtful motives, and upon probably insufficient evidence. Their safety from unjust attack lies in committing the power of prosecution to an officer of this State, who acts under oath, upon official responsibility, whose actions are proclaimed to the entire people, and who can be removed and punished if he does not observe the law.

There certainly is no violation of the Fourteenth Amendment of the Federal Constitution by the adoption of such a method for enforcing a police Act of this Commonwealth.

The reasons for this statement are these:

(a) When the Legislature declares what shall be a crime, no person has the natural right to become a prosecutor of any offender against that law. The utmost he can ask is equal political rights with his fellow-men. If he is deprived of no political rights which they enjoy, then there is no discrimination made against him, and, therefore, there is nothing of which he can complain, and nothing for any provision of the Federal Constitution to redress. All he can ask is a parity of privilege and treatment.

(b) This law places all persons in the same position. Their treatment is equal. The right to commence proceedings under this Act is not extended to any citizen or citizens. It is denied to them all. There is no exception. Therefore, there is no discrimination against any person. The duty of enforcing the law and the power to commence prosecutions rest entirely with an officer appointed for that purpose; and his duty and power with respect to this subject are no greater than the duty and power of other officers of this Commonwealth with respect to the matters committed to their care.

The defendant intimated, rather than stated, that if the power of prosecution was singly lodged with the Dairy and Food Commissioner, the law in this respect would be unconstitutional, because it transgressed the twenty-seventh section of Article III of the Constitution of Pennsylvania.

Let us briefly test that.

That section is in this language:

"No State office shall be continued or created for the inspection or measuring of any merchandise, manufacture or commodity, but any county or municipality may appoint such officer when authorized by law."

It is to be noted that the

"inspection or measuring of any merchandise, manufacture or commodity" -
is not unlawful, as county or municipality could, when authorized by law, make appointments of officers for that purpose.

The prohibition this section contains is merely that a State office for such purpose cannot be created.

Plainly the thought of this section of the Constitution is this:

Inspection and measuring of the articles named may be made for county purposes; that is, for any purposes affecting the particular county. Inspection and measurement of any such articles shall not be made where the same affects the entire State.

As will hereafter appear, the reason for this distinction is that the inspection or measurement for State purposes affected interstate commerce, to the prejudice of this State. Inspection and measurement for county purposes did not affect such commerce, and was domestic and local in its result.

It is confidently asserted:

(1) That the Dairy and Food Commissioner is not such an officer. Commonwealth *vs.* Warren, 217 Pa., 163.

(2) That the duty he performs is not that of inspection or measurement.

An examination of the various statutes predating the adoption of this Constitution and those in existence at the time of its adoption, conclusively prove this.

The Act of April 15, 1835 (P. L. 393), is a comprehensive statute on the subject of the appointment of inspectors, and of their duties. The articles examined were either those exported or imported. Their personal examination and marking or branding were required as pre-requisites of sale. Those articles were not purchased from, or ceased to be the property of, their owners. The fees for the examinations and inspections of such articles, which were not, the property of the inspectors, were charged to, and collected from, their owners. This amounted to a restriction of trade, from which the trade of neighboring competing States was free. This is made plain by the debates of the Constitutional Convention; notably the remarks of Mr. J. Price Wetherill, who introduced this constitutional section, in Vol. 2, pp. 709, 710, Debates on Constitution, and Vol. 7, p. 451; also Mr. Biddle, of Philadelphia, in Vol. 2, p. 711; and of Mr. MacVeagh, Vol. 2, p. 725.

The duty of the Dairy and Food Commissioner is utterly unlike that performed by such inspectors, and is not in the nature of an inspection.

He is a purchaser of food commodities, for the purpose of enforcement of the Act alone.

He has no right to require their production before him, except upon the terms upon which the ordinary purchase is made. He has no power to compel their exhibition and production, except on the terms on which the ordinary customer makes his purchases. He is charged with the enforcement of the Act, and in enforcing the Act proceeds against persons after ascertaining that there has been a violation of the Act.

An inspector always proceeds *in rem*. against the thing itself either by condemning or by approving, and so marks the subject of his inspection so as to indicate either condemnation or approval. The basis of inspection implies the right and power of the inspector to condemn. No power of condemnation of property is given to the Dairy and Food Commissioner under this Act. His sole power is to prosecute persons who are guilty under the provisions of the Act. The inspector examines and passes upon the property of the merchant, which the merchant is required to exhibit to him as a prerequisite of his right to sell.

The examination caused to be made by the Dairy and Food Commissioner is not that of the property of the manufacturer, wholesaler or retailer, but only of property which he has purchased in the ordinary and usual course of business.

There is not even the semblance of any official inspection, which requires a compulsory exhibition by the merchant or manufacturer of his own wares to an inspector before sale or disposal can be made of that property; and the inspector never acquires title to the property which is exhibited to him, but the title to the same remains with the owner thereof as fully and completely as if the inspection had not been made.

The Dairy and Food Commissioner has no right to require any such exhibition, and his power of securing such article is only that of the ordinary purchaser.

He has no power to condemn, or to confiscate, or to withhold from sale any article which he may deem to be prohibited under this law.

His sole power is to proceed against the manufacturer or seller of that article, and upon a repetition of the offense his duty is no greater in respect to its punishment than it was with respect to the first offense.

No method, it is submitted, could have been adopted, which leaves a seller or a manufacturer so free to deal with his goods and merchandise, and yet protects the public from the harm of the manufacture and sale of prohibited goods, more wise a one than this.

It is, therefore, respectfully submitted:

That the Dairy and Food Commissioner is not an inspector or measurer of merchandise, manufacture or commodity;

That the powers granted to, and exercised by him are constitutional, and are no greater than those committed to other State officers for their discharge of equivalent duties;

That the law in question violates no provision of either the State or Federal Constitution;

That it is necessary for the protection of the public health, and that the methods for its enforcement are such as the Legislature was overwhelmingly justified in adopting;

That as the evidence shows the baking-powder in question is known to, and called by, the trade as alum powder, and a respectable and reputable body of chemists has testified that the article found in such powder is alum, their testimony should be accepted as sufficient reason for the judicial determination that the subject in question is statutory alum, even if the testimony of such chemists should be at variance with the testimony of other chemists of character and respectability.

No other construction will, it is respectfully submitted, conform to the decisions already cited, which declare that the interpretation given to the language of a statute of this character must be such as "will fully and effectively accomplish the object of its enactment."

REPORT OF THE STATE VETERINARIAN.

Harrisburg, Pa., January 1, 1910.

Hon. N. B. Critchfield, Secretary of Agriculture.

Dear Sir:—I have the honor to submit the following report upon the work of the State Veterinarian as well as upon the work of the office of the State Livestock Sanitary Board for the year 1909.

During the past year the Department of Agriculture and the State Livestock Sanitary Board suffered an irreparable loss by the death of one who has been instrumental in the formation of the State Livestock Sanitary Board, and in enacting laws that have proven themselves to be of the greatest value in suppressing infectious and contagious diseases of animals. It is with the deepest sorrow I refer to the death of Dr. Leonard Pearson, which took place in September.

Again, the veterinary sanitary work of the State sustained further loss in the resignation of Dr. Louis A. Klein, who resigned early in December to accept the deanship of the Veterinary School of the University of Pennsylvania. Dr. Klein's resignation was received with regret.

The position of Deputy State Veterinarian was filled on December 9th by the appointment of Dr. T. E. Munce by Governor Edwin S. Stuart. Dr. Munce had been an agent of the Meat-Hygiene Service from the time said service was inaugurated in 1907. During the outbreak of foot-and-mouth disease he was in charge of a certain portion of the executive work in the Harrisburg office, and is, therefore, well qualified to assume the duties of his new position.

Since nearly all the work of the past year was done under the supervision of Dr. Pearson and Dr. Klein, it is with a feeling of ill-preparedness that I attempt to compile a detailed report. Dr. Pearson's vast knowledge of sanitary laws and regulations and his long experience made him pre-eminent in livestock sanitary work, and has placed Pennsylvania second to none in the health of her livestock.

During the past year the most important event in relation to the occurrence or repression of diseases of animals was the eradication

are times when it appears that these measures place hardships upon dairymen and breeders; though the great percentage of the stock owners realize that the hardships and temporary inconvenience is for the welfare of the livestock industry, and they are always ready to give their hearty co-operation in the enforcement of the rules and regulations of the State Livestock Sanitary Board.

An advance step was taken during the year by the formation of an association of eastern Livestock Sanitary Boards. The object of this association is for co-operation of the various states relative to the interchange of animals. It is believed that great value will result if uniform regulations are promulgated and will save the shipper much time and inconvenience.

THE MEAT HYGIENE SERVICE.

The agents of the Meat Hygiene Service, during the past year, have been to a large extent engaged in re-examining slaughter houses and meat markets that were examined the previous year, also locating and examining those not previously examined as well as any new establishments. It requires a great amount of time, especially in the rural districts, to thoroughly and systematically locate and examine all establishments. Practically no inspections were made during January, February and March, and but very few during April, the agents being engaged in assisting in eradicating the outbreak of Aphthous fever (foot-and-mouth disease), which prevailed during January, and in enforcing the quarantines made necessary by reason of that disease. The agents being thus engaged in other work during the early part of the year, the number of establishments visited and examinations made, as shown in the following tables, is materially decreased in comparison with the examination during the previous year.

In examining the sanitary condition of the establishments, all animals on the premises to be slaughtered, as well as those being slaughtered, dressed carcasses or parts of carcasses, meat products, casing, etc., were examined; a noticeable change has been observed with respect to the manner of conducting and management of the establishments as well as handling and caring for the meats, as compared with the observations made during the preceding year. All of which changes indicate the beneficial effect of supervision of the meat supply.

The trade in immature (bob) veal is not so extensively carried on as in previous years. A number of dealers who persist in handling "bob veal" were successfully prosecuted during the year. This together with the repeated trips of the agents through the districts in which this trade is carried on, as well as the number of young calves quarantined until of a satisfactory age and the number of carcasses condemned, has had a most wholesome effect.

Various diseased conditions were found, the most common of which were tuberculosis, hog cholera and swine plague, actinomycosis (lump jaw), pneumonia, pleurisy, septicemia, pyemia, echinococcus cysts and a great many parasitic diseases. Complaints were received and investigated regarding the slaughter of emaciated and diseased animals and the sale of diseased meats. Legal proceedings were instituted in four cases, all of which terminated success-

fully, and were as follows: for violation of quarantine, one; slaughter and sale of immature (bob) veal, two; slaughter and sale of diseased animal, one. There was one prosecution under way for the slaughter and sale of a diseased carcass.

Live animals examined,	5,303
Live animals quarantined,	359
Number of carcasses examined,	22,152 $\frac{1}{2}$
Number of carcasses condemned,	584 $\frac{1}{2}$
Parts of carcasses condemned,	2,249
Organs condemned,	2,345
Meat and meat products examined,	547,823 $\frac{1}{2}$ lbs.
Meat and meat products condemned,	4,357 $\frac{1}{2}$ lbs.

NOTE: Regular inspections were not made in Philadelphia and Pittsburg; these cities having local inspectors.

MEAT MARKETS.

County.	Number of meat markets examined.	Number defective on examination.	Number defective on second examination.	Number defective on third examination.	Number defective on fourth examination.
Adams,	14	4			
Allegheny,	*8				
Armstrong,	31	8	1		
Beaver,					
Bedford,	16	8	1		
Berks,	46	11	1		
Blair,	75	1			
Bradford,	27				
Bucks,	46				
Butler,					
Cambria,	58	2			
Cameron,	9				
Carbon,					
Centre,	29	4			
Chester,	51	1			
Clarion,	15	2			
Clearfield,	44	2			
Clyinton,	17				
Columbia,	42	1	8	1	
Crawford,	38	4	1		
Cumberland,	5		5		
Dauphin,	41		16		
Delaware,	47		1		
Elk,	31	3			
Erie,	8				
Fayette,					
Forest,					
Franklin,	17	18			
Fulton,	2	2			
Greene,	18	6			
Huntingdon,	20	6	1		
Indiana,	15				
Jefferson,	34				
Juniata,	4	1			
Lackawanna,	94	5			
Lancaster,					
Lawrence,	118	26			
Lebanon,	30	6			
Lehigh,	6	1			
Luzerne,	229	8	1	1	1
Lycoming,	12				
Mercer,	7	3			
Mifflin,	9	1			
Monroe,	7				
Montgomery,	138	7			
Montour,	9		2		
McKean,	26	2			
Northampton,	94	5	1		
Northumberland,	97	2	1		
Perry,	6	2			
Philadelphia,	48	6			
Pike,					
Potter,	9	1			
Schuylkill,	125	30			
Snyder,	10				
Somerset,	55	29	4		
Sullivan,	7				
Susquehanna,	18	1			
Tioga,	9	2			
Union,	16				
Venango,	43	2	1		
Warren,	15	1			
Washington,	2				
Wayne,	6	1			
Westmoreland,	1				
Wyoming,	16	1	1		
York,	103	28	1		
Total,	2,124	255	25	2	1

*Meat markets in Allegheny county outside of Pittsburgh, the establishments in these cities being examined by local inspectors.

†These examinations were made incidental to other work. No general examination was made of meat markets in Philadelphia because there is a force of local inspectors to do the work.

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SLAUGHTER HOUSES.

County.	Number of slaughter houses inspected.	Number defective on first inspection.	Number defective on sec- ond inspection.	Number defective on third inspection.	Number defective on fourth inspection.
Adams, -----	18	4			
Allegheny, -----	33				
Armstrong, -----	14	8	1		
Bedford, -----	19	15	1		
Berks, -----	102	48	3		
Blair, -----	29	8	5	1	
Bradford, -----	29	10	3		
Bucks, -----	54	17	15		
Cambria, -----	27	11			
Carbon, -----	1				
Centre, -----	21	13			
Chester, -----	43	15	1		
Clarion, -----	6	6			
Clearfield, -----	26	15	1		
Clinton, -----	16	5	1		
Crawford, -----	8	1			
Columbia, -----	22	14			
Cumberland, -----	10	10	1		
Dauphin, -----	28	15	2		
Delaware, -----	17	3	3	1	1
EIK, -----	8	5	1		
Erie, -----	10				
Franklin, -----	20	19			
Fulton, -----	4	4	1		
Greene, -----	16	13	1		
Huntingdon, -----	5	3			
Indiana, -----	7	6			
Jefferson, -----	6	1			
Juniata, -----	3	1			
Lackawanna, -----	16	9			
Lancaster, -----	185	37			
Lawrence, -----	2				
Lebanon, -----	46	24			
Lehigh, -----	4	4			
Luzerne, -----	22	3	1		
Lycoming, -----	37	10	1		
Mercer, -----	6	4			
Mifflin, -----	10	3			
Monroe, -----	3				
Montgomery, -----	102	25	1		
Montour, -----	8	4	4		
McKean, -----	11	7			
Northampton, -----	21	9	1		
Northumberland, -----	50	16	3		
Perry, -----	12	4			
Philadelphia, -----	12				
Potter, -----	7	5	1		
Schuylkill, -----	42	26			
Snyder, -----	22	13	2		
Somerset, -----	34	27	5		
Sullivan, -----	7	6			
Susquehanna, -----	7	3	1		
Tioga, -----	37	17	4		
Union, -----	21	8	3	1	1
Venango, -----	5	1	1		
Warren, -----	5				
Washington, -----	8				
Wayne, -----	5	2			
Westmoreland, -----	17	1	1		
Wyoming, -----	17	1	1		
York, -----	105	35			
Total, -----	1,378	575	68	3	

*Slaughter houses in Allegheny county outside of Pittsburg, the establishments in these cities being examined by local inspectors.

†These examinations were made incidental to other work. No general examination was made of slaughter houses in Philadelphia because there is a force of local inspectors to do the work.

THE INSPECTION OF DAIRIES.

The cities and boroughs in the following table made application for the assistance and received the co-operation of the Board in the inspection of the sources of milk supplies.

There were 583 premises visited and herds examined comprising 13,385 cattle. A report is made of each premises and herd examined on a blank similar to the following form and is classified under three heads: PHYSICAL CONDITION OF THE HERD AND HERD HYGIENE, EQUIPMENT, and ADMINISTRATION.

..... 190....
..... P. O., Co., Pa.

TO THE STATE LIVESTOCK SANITARY BOARD,
HARRISBURG, PA.

I have inspected the herd and premises of Mr.
of..... P. O., Co., Pa., and submit
the following report:

The entire herd consists of cows.....; heifers over one year old.....; calves....., steers.....; bulls.....; total..... Of these..... show symptoms of disease, for each of which a separate report is enclosed herewith.

Perfect Score. Recorded Points.

Physical condition of the herd and herd hygiene.

Condition of nutrition,	5
Absence of general disease,	10
Condition of teats,	10
Facilities for isolation,	3
Food and water,	5

Equipment.

Stable (location, construction, size, fittings, floors, walls, ceiling, gutters, mangers, lighting, ventilation, provision for comfort of cows),	8
Barnyard and dung-stead (location, drainage, construction),	5
Milk room (location, construction, facilities for rapid cooling and for cold storage),	5
Utensils (construction, size, adequacy, small top or hooded pail),	7
Facilities for washing and sterilizing (ample supply of pure water, supply of steam or hot water, suitable space and apparatus),	8

	Perfect Score.	Recorded Points.
Administration.		
Health of attendants,	10	
Cleanliness of cows and their surroundings (clean udder, flanks, tail; clean stable and yard),	6	6
.....
Method of milking (quiet and rapid with clean, dry hands; discard foremilk; use small top pail; clean clothing for milkers),	6	6
.....
Prompt and efficient cooling and storage at low temperature in a clean room,	7	7
.....
Protection during transportation,	5	5
	<u>100</u>	<u>100</u>

Total recorded points,

*Deduct for,

Recorded score,

The sanitary conditions of the above described dairy are,

.....
Examined by
Date, 190.....

*(For especially unsanitary conditions in any group, special discounts may be made from the total recorded points according to the probable danger of infection, contamination or deterioration that may result from the continuance of the faulty conditions.)

If the recorded score is 90 or above the dairy is EXCELLENT.

If the recorded score is 80 or above the dairy is GOOD.

If the recorded score is 70 or above the dairy is FAIR.

If the recorded score is 60 or above the dairy is PROBATIONARY.

If the recorded score is 59 or below the dairy should be decidedly improved at once.

Each animal in every herd is subjected to a careful physical examination, and any found to present evidence of an infectious or contagious disease is removed from the herd and a report made of its condition on a blank similar to the form below.

..... 190....

..... P. O., Co., Pa.

To the STATE LIVESTOCK SANITARY BOARD,
HARRISBURG, PA.

I, Veterinary surgeon, hereby certify
that on the day of 190.., I examined the following
described animal, the property of
at and report as follows:

Description,
 History,
 Condition,
 Pulse, Respirations, number, character,
 Temperature, Cough, character of cough,
 Percussion of chest,
 Auscultation of lungs,
 Condition of udder,
 Condition of teats,
 Condition of faeces,
 Discharge from vulva, character,
 Other symptoms present,

 There is, in my opinion, reasonable cause to believe that this animal
 is afflicted with the disease known as.....
 The animal has..... been isolated from cows in milk.

Veterinarian.

Action is then taken with respect to properly disposing of all such affected animals according to the nature of the disease with which it is affected and in accordance with the rules and regulations of the Board.

DAIRY INSPECTION FOR 1909.

Cities and Boroughs.	Premises.	No. animals on premises.	Average score.
Bloomsburg,	39	328	87
Hanover,	32	439	75
Homestead,	41	661	69
Oil City,	54	865	75
Penn Argyle,	27	197	73
Silverly,	4	52	77
Tidlout,	6	44	73
Warren,	28	560	80
West Pittston,	12	263	75
Wilkes-Barre,	330	9,956	79
Total,	583	18,885	77

The table indicates that the dairies supplying milk to some municipalities fared, in so far as scoring is concerned, much better than others, but taking into account every phase of the work and also that dairy inspection is in its infancy, the result of the past years' work is indeed very encouraging. It is to be hoped that the inspections so far made may be the means of stimulating a general interest in dairy inspection and that other cities and boroughs will take advantage and make application for the assistance the Board is prepared and will gladly render.

TUBERCULOSIS.

Counties.

		Animals Examined.		Examiners.		Tuberculin tested.		Total number animals tested and examined.		Number condemned on tuberculin test.		Number condemned on physical examination.		Total number condemned.		Percentage based on number tested.		Unrested cattle slaughtered and found to be tuberculous to such an extent as to render beef unfit for food.	
50	6	56	16	6	6	100	21	100	21	4	4	2	2	22	39.2				
66	5	65	25	5	5	112	52	112	52	2	2	2	2	23	23				
26	2	27	27	2	2	104	104	104	104	1	1	1	1	100	100				
111	1	112	52	1	1	90	90	90	90	7	7	1	1	47.3	47.3				
338	5	338	104	5	5	104	104	104	104	4	4	4	4	14.8	14.8				
988	1	987	80	1	1	80	80	80	80	1	1	1	1	81	8.6	20			
295	72	297	27	2	2	87	8	87	8	9	9	8	8	36	9.8	40			
84	8	84	8	1	1	20	7	20	7	1	1	3	3	11	12.6				
19	1	19	1	1	1	90	24	90	24	7	7	1	1	8	40.6	1			
101	3	101	1	3	3	290	35	290	35	1	1	3	3	24	26.6				
2,064	246	2,310	35	3	3	384	35	384	35	3	3	4	4	384	14.4	38			
13	1	14	14	1	1	49	7	49	7	4	4	1	1	1	7.14				
41	8	41	4	4	4	179	23	179	23	2	2	2	2	23	12.8				
179	9	179	24	9	9	140	39	140	39	16	16	2	2	36	8.33	1			
16	9	16	255	9	9	255	42	255	42	14	14	14	14	56	38.33	10			
91	49	91	49	49	49	448	20	448	20	7	7	7	7	27	21.06	10			
198	59	198	42	59	59	448	20	448	20	14	14	14	14	56	21.06	5			
457	11	457	20	11	11	243	38	243	38	9	9	9	9	45	18.6	2			
147	98	147	29	98	98	61	1	61	1	1	1	1	1	30	58.5				
50	1	50	1	1	1	48	1	48	1	1	1	1	1	7	16.27	1			
32	11	32	11	11	11	11	11	11	11	11	11	11	11	6	6				

TUBERCULOSIS—Continued.

Counties.		Animals Examined.		Examined Physically.		Total number animals tested and examined.		Number condemned on tuberculin test.		Number condemned on tuberculin test.		Number condemned on physical examination.		Percent trace (based on number tested and examined).		Unrested cattle slaughtered and round to be tested as to render dead unfit for food.	
		11	9	20	5	5	26	1									
		6	10	16	2	2	12.5										
		13	23	38	2	2	6.5										
		67	67	67	2	2	2.8										
		300	422	722	116	83	199	18									
		60	1	61	8	1	9	14.75									
		70	102	172	10	18	33	13.87									
		168		168	9	9	16	9.4									
		41	9	52	8	2	9	18.									
		49	7	40	40	5	10	19.25									
		98		98	39	5	12	5.06									
		197		197	92	2	2	1.57									
		408	16	408	48	12	34	11.5									
		9	7	16	2	2	12.5	40									
		111	28	139	1	5	6										
		97	1	98	28	1	6	4.3									
		46	24	70	7	1	24	24.4									
		7	1	8	1	1	7	14									
		181	2	188	7	1	2	25.									
		8	15	46	3	1	8	4.3									
		31	1	31	7	1	9	26.08									
		30			5		1	12									
		3	2	35			2	26.8									
		28	7	35			1	40.									
		3		3			1	2.8									
		776	51	887	67	10	67										
		158	48	206	2	6	8	8.9									
					1		1	3.8									
								1									

184	8	187	21	2	23	32.8		
63	3	70	1	4	6	18.6		
5	28	87	10	1	11	8.9		
121	2	128	247	101	4	106	42.5	
231	16	16	150	13	3	16	10.86	1
153	17	263	50	39	39	38.9		
188	124							27

The above table does not include the inspection and tuberculin test of cows and such other cattle as are for breeding purposes, which have been driven or shipped into Pennsylvania during the year 1909. There were 27,435 cattle imported during the year as compared to 21,843 animals during the previous year. Of the 27,435 animals tested, either prior to importation or after their arrival at destination, 199 reacted (.72 per cent.) This is lower than for 1908 which represented .93 per cent.

The following table will give the number of animals shipped on permit, those tested previous to shipment as well as those shipped without a permit:

**CATTLE IMPORTED INTO THE STATE FOR DAIRY PURPOSES AND
TUBERCULIN TESTED UNDER ACT APPROVED MAY 26, 1897,
AS AMENDED BY THE ACT OF APRIL 5, 1905.**

	Tuberculin tested.	Number reactors.	Disposition of reactors.
Cattle imported on permit and tuberculin tested at destination,--	14,419	45	Killed.
Cattle discovered to be shipped without permit and afterwards tuberculin tested at destination, -----	8,442	88	Killed.
Cattle tuberculin tested previous to shipment into Pennsylvania,-----	1,156	31	Not shipped.
Cattle shipped without permit and detained at Pittsburg for tuberculin test, -----	3,418	35	Killed.
Total, -----	27,435	199	

GLANDERS.

With the exception of Berks and Philadelphia counties, the State has been comparatively free from glanders during the year 1909. It was reported from twenty-two counties, though on investigation it was found that in five of these counties the report was not well founded and the alleged outbreak was proven to be another condition. In seven of the remaining seventeen counties but one horse was condemned. The balance of the cases existed in ten counties. Of the number of animals examined, both physically and tested with mallein, 121 were condemned and destroyed.

The following table will illustrate the distribution of the disease,

hospital at Philadelphia from an adjoining state for treatment and was found to be affected with glanders, and with the consent of the owner was destroyed without indemnity. There were thirty-six supposed outbreaks of glanders reported to this office which, upon investigation, proved to be some other condition, such as ulcerated tooth, collection of pus in the sinus, elephantitis, epizootic lymphangitis, etc. These thirty-six alleged outbreaks required the examination of 148 animals. When the table was computed, the records relative to glanders in Philadelphia were not complete and some stables were still under observation, there being animals in these stables that were under quarantine and were being held for a retest with mallein and to be disposed of later:

GLANDERS.

Counties.	Number of supposed cases reported.	Number of stables inspected.	Animals examined physically.	Animals tested with mallein.	Animals condemned on physical examination.	Animals condemned on mallein test.	Total number of animals condemned.
Adams, .	1	1	10	9	1	—	1
Allegheny, .	1	1	4	4	—	4	4
Armstrong, .	1	1	2	—	1	—	1
Berks, .	6	6	26	23	3	—	3
Blair, .	2	2	10	—	—	—	—
Bucks, .	9	14	100	72	10	7	17
Carbon, .	2	2	14	14	—	6	6
Centre, .	2	2	4	2	1	—	1
Delaware, .	6	5	12	11	1	3	4
Erie, .	2	2	10	8	2	—	2
Lancaster, .	3	3	9	8	1	1	2
Lehigh, .	1	1	1	1	—	—	—
Luzerne, .	1	1	1	1	1	—	1
Montgomery, .	6	6	31	26	8	3	11
Northampton, .	1	1	2	2	—	—	—
Philadelphia, .	57	59	473	512	40	22	62
Potter, .	2	2	10	7	3	—	3
Schuylkill, .	1	1	23	2	—	—	—
Susquehanna, .	1	1	1	—	1	—	1
Tioga, .	3	3	5	3	1	—	1
Washington, .	1	1	1	—	1	—	1
York, .	1	1	—	1	—	—	—

RABIES.

The disease known as rabies or hydrophobia has been more prevalent during the year past than in any of the former years since the existence of the State Livestock Sanitary Board, and outbreaks have been reported in thirty-nine of the counties of the State. In many instances it was necessary to establish a general quarantine of an entire borough, township, and on some occasions, the entire county. There were 503 cases reported, which necessitated the quarantining of 2,263 dogs, which had either been bitten or exposed to the disease. There were 1,822 animals destroyed—a greater portion of which are not included in the number of animals quarantined, as they were destroyed immediately following the bite or exposure of a rabid animal. This, of course, did not represent the actual number of animals destroyed, as in many cases owners kill their exposed animals before an investigation of the outbreak was made by the agent of

the Board, who would report "all dogs in the vicinity destroyed," or "all exposed animals destroyed." It is not possible to obtain the exact number of people bitten by animals suffering with rabies or hydrophobia, though reports show 204 persons were bitten throughout the year.

In many instances the State Livestock Sanitary Board has had the able co-operation of borough and city officials in the enforcement of quarantines, though, in a few instances, there has been some opposition, which has been due no doubt to the lack of knowledge of this disease. I believe, after the people know the great danger in permitting dogs that have been exposed to a rabid animal to run at large, that we may look for a rapid decrease in the number of cases. To control this disease, it will be necessary to have the co-operation of the local authorities, especially the constables in enforcing the quarantines.

The following table will give an outline by counties of the number of cases reported, animals quarantined, localities quarantined, animals destroyed and persons bitten:

RABIES.

Counties.	Number of cases reported.	Animals quarantined.	Localities quarantined.	Animals destroyed.	Persons bitten.
Adams, -----	2	1	-----	1	-----
Allegheny, -----	14	4	1	91	16
Armstrong, -----	23	59	-----	6	1
Beaver, -----	5	7	1	80	4
Bedford, -----	8	13	-----	-----	-----
Berks, -----	11	153	-----	34	3
Blair, -----	9	19	-----	4	4
Bradford, -----	43	43	5	227	4
Bucks, -----	12	115	3	89	5
Butler, -----	6	79	2	37	2
Cambria, -----	7	11	-----	17	13
Chester, -----	48	568	4	183	9
Columbia, -----	6	21	-----	4	1
Crawford, -----	15	173	2	147	19
Cumberland, -----	3	7	-----	-----	-----
Dauphin, -----	2	-----	1	35	2
Delaware, -----	44	110	1	88	12
Erie, -----	18	40	2	15	16
Fayette, -----	1	20	-----	1	2
Franklin, -----	1	-----	-----	1	1
Greene, -----	1	-----	-----	2	-----
Indiana, -----	3	160	1	60	-----
Lackawanna. -----	5	3	-----	2	4

ANTHRAX.

Anthrax has occurred in 161 herds throughout sixteen counties as shown in table. Before a laboratory diagnosis could be established and an investigation made, 122 animals died. The practice of the State Livestock Sanitary Board is, first, to establish a diagnosis by laboratory examination whenever an animal has died with symptoms suspicious of anthrax. It requires practically twenty-four hours for such an examination, and if the same proves positive, all exposed animals in the locality from which the specimen was submitted are vaccinated. It is interesting to note, during the past year, not a single animal died following the vaccination. The control of this disease is due largely to the thorough vaccination in the early spring of all animals in an infected district. It has been found that tanneries are capable of infecting streams with the spores of anthrax, and these are later washed upon the pasture lands bordering the stream. It is important that animals during the period in which the vaccinations are made be kept away from all source of infection, and should not be allowed to go on infected pastures or be placed in infected stables for at least ten days following the final vaccination. In the case of an animal supposed to be affected with anthrax, it is most advisable not to open the carcass, and if a specimen is desired to be sent to the laboratory an ear can be removed from the body and placed in a clean glass fruit jar that may be hermetically closed. This jar is then packed in sawdust and ice in a bucket and sent to the laboratory. The blood vessels in the ear contain sufficient blood for laboratory examination.

The cause of anthrax is a large bacillus which is found circulating in the blood and is most numerous in the spleen. It does not form spores except when in contact with oxygen. The bacilli are moderately resistant to heat and germicides, but the spores are extremely resistant and will withstand boiling water for a long time. To prevent the bacilli from forming spores, the carcass is not opened and should be buried at least six feet under the surface of the ground and well covered with lime. It is preferable, however, to burn the carcasses of animals dying with anthrax provided suitable material is at hand.

The following table will give in detail the number of herds affected, animals vaccinated, as well as the number of deaths previous to vaccination:

ANTHRAX.

County.	Herd.	Number of animals vaccinated	Number of animals dead.		No animals died following vaccination.
			Previous to vaccination.	Following vaccination.	
Berks,	13	112	33	1	
Bradford,	5	97	12		
Bucks,	2	14			
Chester,	7	155	7		
Elk,	3	12	11	4	
Erie,	2	48			
Jefferson,	1	8	7	1	
Lackawanna,	95	105	1		
Lycoming,	1	8	3		
Luzerne,	1	2	4		
McKean,	9	184	12		
Montgomery,	2	46	5		
Potter,	6	41	11		
Susquehanna,	6	129	2		
Tioga,	7	48	9		
Warren,	1	16	1		

BLACKLEG.

The disease known as blackleg or blackquarter has appeared in seventeen counties, representing 126 head. The number of deaths the past year is somewhat greater than for the previous year; in 1909 there were 45 deaths compared to 28 deaths in 1908. The remaining animals on the infected farms, which were 1,310, were vaccinated with blackleg vaccine, and after the same was completed it is gratifying to note that there were no further deaths reported. The retarding of this disease is due largely to early vaccination, and the fact that the place where the disease is most likely to occur has been located a careful oversight of these localities is maintained and vaccination is applied in advance of the pasturing season to animals on farms where the disease is believed to be. The table will show the distribution of the disease throughout the State as well as the

BLACKLEG.

County.	Herd.	Number of vaccinated animals.	Previous to vaccination.	Following vaccination.	Number of animals dead.
Blair,	4	14	5		
Bradford,	8	78			
Bedford,	8	41	8		
Butler,	1	23	1		
Clarion,	11	106	22		
Erie,	17	178	1		
Forest,	1	4			
Franklin,	1	39	5		
Huntingdon,	1	14			
Potter,	1	11			
Somerset,	2	14	4		
Sullivan,	1	18			
Susquehanna,	41	465	88		
Warren,	4	57	1		
Wayne,	25	232	83		
Westmoreland,	1	4	5		
Wyoming,	4	25			
			No animal died after vaccination.		

MANGE.

With the exception of Philadelphia county, mange has not appeared to any alarming extent. It has been found in 19 counties, though in 6 of these counties there was only 1 animal affected. Of the 248 animals affected throughout the State, there were only 11 died or destroyed.

The following table will give an outline of the supposed cases, animals affected, as well as animals cured and released:

MANGE.

County.	Number of supposed cases reported.	Number stables inspected.	Number of animals examined.	Number of animals affected and quarantined.	Number of animals cured and released from quarantine.	Number of animals died and destroyed.
Berks,	8	8	3	3	3	1
Bradford,	1	1	1	1	1	4
Bucks,	8	9	9	9	5	
Centre,	1	1	1	1	1	
Chester,	1	1	5	5	5	
Clearfield,	1	6	11	11	11	
Columbia,	1	1	10	2	2	
Delaware,	1	1	1	1	1	
Lebanon,	1	1	1	1	1	
Luzerne,	8	8	5	5	5	
Mercer,	3	3	4	4	4	
Monroe,	9	9	11	11	10	1
Montgomery,	4	4	7	7	6	1
Northumberland,	4	4	4	4	3	1
Philadelphia,	144	144	107	164	1	
Schuylkill,	1	1	1	1	1	
Somerset,	1	2	14	14	13	1
Wayne,	1	1	1	1	1	
Wyoming,	2	2	2	2	2	

However, at this writing, the information relative to the situation in Philadelphia in connection with this disease is not complete, as it has not been the policy to release affected animals from all quarantine restrictions when such animals are located in an infected district or a congested locality. In such cases the animals when in proper condition are released from strict quarantine and are placed in what is known as a conditional or partial quarantine which permits the owner the use of the animal under certain restrictions.

ACTINOMYCOSIS OR LUMP JAW.

The disease known as actinomycosis, lump jaw or big jaw, has been reported from 16 counties during the past year, representing a total number of 27 cases. No doubt this does not cover all of the cases, owing to the fact that the disease is not of special importance in connection with the veterinary sanitary service of the State. It is not required by law or the regulations of the State Livestock Sanitary Board that animals with actinomycosis shall be killed, or even that they shall be quarantined. Such animals are not paid for, appraised or condemned by the State. The only restriction in relation to such animals is as to their use as food producers.

In cases where animals are slaughtered for food it is required that the head shall be condemned, and if lesions of actinomycosis are found in other parts of the body the same principle should be applied in passing the flesh for food as in force for tuberculosis.

The following table will show the distribution of the disease as well as the action taken in each case:

ACTINOMYCOSIS OR "LUMP JAW."

County.	Number of cases reported.	Action Taken.
Bedford,	1	No action taken; no discharging lesion.
Butler,	1	Recovered, after treatment.
Cambria,	1	Treatment advised.
Centre,	10	Treatment recommended; one cow died.
Cumberland,	1	Killed, portion used for food.
Dauphin,	1	Treatment recommended.
Fayette	1	Quarantined and killed.

HOG CHOLERA.

Hog cholera was reported from 20 counties covering 39 herds of hogs, including 1,403 animals exposed. The largest outbreak occurred in Venango and Warren counties. This disease is usually traceable to importation of hogs from the West or from hogs that have been shipped in stock cars that have not been previously disinfected.

The following table shows the number of cases, the number of deaths and the distribution of the disease throughout the State:

HOG CHOLERA.

County.	Herds.	Number of exposed hogs.	Number sick.	Number dead.
Blair, .	2	25	18	16
Bucks, .	5	50	41	43
Carbon, .	2	18	17	12
Chester, .	4	47	11	5
Columbia, .	4	52	37	31
Cumberland, .	4	81	38	41
Delaware, .	1	20	24	20
Franklin, .	3	12	82	24
Huntingdon, .	2	10	9	7
Jefferson, .	1	29	25	25
Lancaster, .	2	11	10	10
Lehigh, .	1	8	8	8
Mercer, .	1	18	18	15
Monroe, .	1	34	46	46
Montgomery, .	1	40	1	1
Philadelphia, .	1	8	3	2
Venango, .	1	600	118	424
Warren, .	1	100	195	Not known.
Westmoreland, .	1	10	4	3
York, .	1	100	60	35

EPIZOOTIC LYMPHANGITIS.

This disease is still prevalent but is well under control no serious center of infection being discovered. 56 cases were reported as is shown in the table below. 23 animals were destroyed, one of which was reported and quarantined the previous year and located in Montgomery county.

County.	Cases reported.	No. of animals destroyed.
Armstrong,	3	2
Bradford,	1	1
Butler,	8	2
Clarion,	7	3
Clearfield,	1	
Crawford,	8	1
Elk,	1	1
Erie,	1	1
Fayette,	2	1
Forest,	1	1
Franklin,	1	
Indiana,	1	
Jefferson,	14	5
Lancaster,	1	1
Lawrence,	1	
Montgomery,		1
Mercer,	4	2
Northumberland,	1	
Venango,	4	1
Westmoreland,	1	1

Methods of combating this disease were outlined in previous reports and since then no material change has been made.

Under the laboratory and farm, a report is made of the specimens received and examined and investigations carried on.

TEXAS FEVER.

On August 26th a car containing thirty-five cattle, mostly steers, was received by a dealer from Chicago, Illinois, and unloaded at the Mount Joy stock yards, Lancaster county. These cattle were sold into sixteen herds. Two of the steers in one of the herds became ill September 7th, both of which died September 9th. Lesions typical of Texas fever were observed at autopsy in both cases. A further examination was made and a number of ticks were found on various parts of both animals. Two other steers died within a few days of the same disease on two separate premises.

All the cattle in the three exposed herds were immediately quarantined. All cattle in the remaining herds into which the tick-

On account of the lateness of the season, the ticks did not have sufficient time to mature the early frosts destroyed them, thus preventing the spread of infection and the death of many cattle.

MISCELLANEOUS DISEASES.

During the year 1909 there were 113 cases of various diseases that have not heretofore been enumerated in this report that came to the attention of the State Livestock Sanitary Board. These cases necessitated a great amount of correspondence, in which advice was given relative to the sanitary precautions to be taken and the treatment to be administered. In some of the cases history was sufficient to suspect an infectious or contagious disease, and in such cases an investigation was made; while in other instances the veterinarians or owners reporting the same were requested to send specimens to the laboratory in order that it might be proven whether the condition was one of an infectious or contagious nature. In all cases where the condition was found to be one transmissible to other animals, instructions were given relative to care and isolation of the subject.

The following list of diseases indicate some of those that were handled in the above described manner:

Foul claw.
Gastro-Enteric-Hepatitis of turkeys.
Distemper.
Chronic Dermatitis.
Nasal Catarrh.
Bronchitis.
Pneumonia.
Intestinal Parasites in sheep.
Variola.
Nodular disease of sheep.
Hemorrhagic Septicemia.
Leucorrhoea.
Several supposed cases of foot-and-mouth disease, upon which the diagnosis was not confirmed.
Milk fever.
Roup.
Cerebro Spinal Menengitis.
Contagious Ophthalmia.
Forage poisoning,
and many others of a similar nature, but of less importance.

It was necessary for the Board to investigate a number of exposed cases of advanced tuberculosis, but on close investigation, it was found that the animal or animals in question were affected with a disease other than tuberculosis.

Six outbreaks of contagious ophthalmia were reported during the year; 116 cattle were affected or exposed to infection; of this number one animal lost its sight entirely, while the sight of several other animals was impaired.

HORSE BREEDING.

The work to encourage the breeding of horses, to require the registration of stallions and the enforcement thereof, has been under the direct supervision of Dr. Carl. W. Gay, Director of Horse Breeding, who has submitted the following report covering the year 1909:

A marked increase is noticed in the number of stallions licensed this year in compliance with the law requiring the enrollment and licensing of all stallions standing for public service in this State. A total of 2,254 licenses have been issued during 1909, as compared with a total of 2,016 for 1908.

The benefits of this law are clearly demonstrated by the great increase in the number of pure bred stallions enrolled during 1909, which is 823, against 666 for 1908, a gain of 157, or nearly 24 per cent. There were 1,427 grade licenses issued as compared with 1,336 during 1908, an increase of less than 7 per cent. Four cross bred licenses were again issued.

Of the pure bred stallions licensed, 290 were Percheron, 253 Standardbred, 48 Belgian, 43 Shire, 36 German Coach, 33 French Draft, 30 Clydesdale, 29 Hackney, 24 French Coach, 11 Morgan, 10 Thoroughbred, 6 Saddle, 5 Cleveland Bay, 2 Shetland, and one each of Orloff, Suffolk and Yorkshire.

The greatest numerical increase over 1908 is in the Percheron, being 59, although proportionately the Belgian has made the greatest gain, having increased 14 in number or 41 per cent. In fact all the breeds progressed in number with the exception of the Morgan, which decreased at the rate of about 31 per cent.

During 1909 Circular No. 16, a comprehensive bulletin of 142 pages containing an article on the "Present Status of the Horse Breeding Industry in Pennsylvania," a copy of the stallion law, copies of the various blank forms which must be properly filled out when application is made for a stallion license, a directory of stallions and their owners arranged numerically and also according to counties, was published. The county list was found to be very useful inasmuch as parties concerned in the horse breeding industry could easily locate the various stallions in their respective vicinities. This publication was widely distributed in order to give the horse owners of this State an idea of what this Board has been accomplishing in horse breeding work.

Another booklet, Bulletin No. 181, entitled, "Timely Hints to Horse Breeders," was also issued by the Department of Agriculture, which contained much valuable information for owners of stallions and brood mares. This, too, had wide distribution throughout the State. Subsequent to the first distribution of this bulletin, numerous requests were received for copies of the same which were promptly complied with. The interest taken in this book by the farmers generally, indicates their desire to raise horses and shows their cognizance of the fact that raising market types of horses is a good financial investment.

These bulletins were a feature of the educational campaign instituted by the Board. In addition, exhibits and demonstrations were made at various county fairs, farmers' institutes and movable schools of agriculture. These exhibits consisted of exceptionally good photographs of all classes of horses from the minute Shetland to the

enormous drafter, plainly labeled, to illustrate the types for which there is the strongest demand and most profit in producing, also charts showing the relative proportion of grade and pure bred stallions, proportionate representation of the breeds, the number of stallions standing in each county, and the relative increase of pure breeds over grades in this State, were exhibited. A supply of all literature pertaining to horse breeding published by this Board was made available to those who cared for it and a representative of the Board was present to explain the work in horse breeding. The object of those charged with the administration of the stallion law is to elaborate on this educational work, as it is found to be very beneficial.

An effort was made to organize stallion and colt show associations in every county of the State by placing the matter before some representative horseman in each. This effort met with success in Crawford, Mercer, Tioga and Erie counties. Although held rather late in the season, these exhibitions were liberally patronized by the stallion owners and the scheme in general was heartily endorsed. Plans are already under way for a repetition on an enlarged scale of each of the shows already held, and it is probable that this work will be extended into more counties another season. It has been found that these events are taken advantage of by the buyers to locate desirable market horses and are, therefore, a direct benefit to the horse owners in general.

A large number of very high class young draft stallions, some of which have been ribbon winners at the most prominent shows in America and abroad, have been brought into Pennsylvania during the past year. This demonstrates the fact that the stallioneer appreciates the protection afforded him by the prevailing law. In many cases, especially in the western section of the State, men who owned one stallion, generally of mediocre calibre, have invested three to four times his value and procured a horse of exceptional merit for which the increase in service fee has been slight if any. The mare owner, as a rule, will not pay the high fee which really should be charged for the superior stallion, therefore, the owner must set his price comparatively low and depend on getting a large number of mares which is usually the case. The fee charged by the stallion owner varies, of course, depending on the breed and the individuality of the horse standing for service, and the amount of competition offered. From five to twenty dollars is the range of price, ten to fifteen dollars generally procuring the service of the best draft stallion, frequently with the insurance of a standing foal.

Licenses have been issued to some stallions which were actually unsound, but this has only been done in instances where the individuality of the stallion in other respects and the uniform merit of his get seemed to justify such action.

It has not been possible with the funds and assistance available to make a personal inspection of all stallions licensed so that there are still, no doubt, many inferior stallions standing for service. These, however, will gradually be weeded out as their existence is detected. While it has been impossible to disqualify undesirable stallions in every case, much has been accomplished in the way of preventing misrepresentation of certain horses. The mare owner, therefore, has the opportunity of discriminating.

One of the most discouraging features of stallion owning in Pennsylvania, is the absence of a Lien Law, which in many states grants the stallion owner a lien on the get, or dam and get for the service fee, thus insuring payment. Under existing conditions settlement is often avoided by the mare owner, who is seldom expected to pay for his mare's service until after she has foaled. Legislation in this direction would surely increase the number of superior stallions in this State.

REPORT OF THE LABORATORY OF MILK HYGIENE.

The work of the laboratory of milk hygiene has been conducted during the past year by Dr. H. C. Campbell, and is located in connection with the other laboratories of the State Livestock Sanitary Board in the new Veterinary School at Thirty-Ninth street and Woodland avenue, Philadelphia. The work is outlined and supervised in conjunction with the Bureau of Animal industry, United States Department of Agriculture.

The following brief report has been submitted by Dr. H. C. Campbell as giving an outline of the work that has been done during the past year:

Under the directions of Dr. John R. Mohler, Chief of the Pathological Division of the Bureau of Animal Industry, and the late Dr. Leonard Pearson, an experiment was conducted to determine what percentage of Philadelphia's milk supply contained tubercle bacilli. One hundred and fifty samples of milk were collected from stores throughout Philadelphia, and examined for the presence of tubercle bacilli. Out of the one hundred and fifty examined, 13.8 per cent. were found to contain tubercle bacilli virulent for guinea pigs. Only the samples of milk that were capable of producing lesions of tuberculosis in animals upon inoculations were included in the percentage above stated.

With the co-operation of Dr. John Reichel, Chief of the Laboratory of the State Livestock Sanitary Board, an organism producing a bad odor and flavor in several samples of market milk was isolated.

Weekly bacteriological examinations were made of samples of certified milk and cream from seven different dealers surrounding Philadelphia; the milk and cream of these dealers having been certified by the Philadelphia Pediatric Society. All samples of milk that contained more than 10,000 bacteria per cubic centimeter, and all samples of cream that contained more than 25,000 bacteria per cubic centimeter, were reported to the Secretary of the aforementioned Society.

The maximum bacterial count of the Society for milk is 10,000 per cubic centimeter and for cream 25,000 per cubic centimeter. When the count exceeds these figures the Society may withdraw this certification of the milk and cream of that particular dairymen.

REPORT OF THE BACTERIOLOGICAL LABORATORY.

The pathological and bacteriological work including the preparation of tuberculin, anthrax vaccine, etc., has been conducted by Dr. John Reichel, Chief of the Laboratory, assisted by Dr. John H. Engle.

The following report is submitted by Dr. Reichel showing the character and amount of work done by the laboratory during the past year.

During the year the following biological products were made to meet the demands made of the laboratory:

TUBERCULIN. 32,065 c. c. of the concentrated tuberculin have been made requiring the preparation and inoculation of 2,801 flasks, each containing 200 c.c. of neutral glycerin bouillon and 22 flasks each containing 1,000 c.c. of neutral glycerin bouillon. The tuberculin prepared during the past year is within a few c.c. of twice the amount prepared in 1908. The tuberculin was prepared by growing four strains of tubercle bacilli for the purpose; culture B. I. and M recognized as tubercle bacilli of the human type and culture L and H recognized as tubercle bacilli of the bovine type. The tuberculin prepared from these bovine and human types of tubercle bacilli was kept separate and tested upon animals known to be tuberculous with the object of determining whether there existed any difference in the strength or value when used for the diagnosing of tuberculosis of animals. The results obtained, however, failed to show that there was any difference between the tuberculin prepared from the human type of tubercle bacilli when compared with the tuberculin prepared from the bovine type of tubercle bacillus. 39,402 doses of tuberculin solution each containing 0.4 c.c. of concentrated tuberculin were sent out for the initial test of cattle; 4,881 doses each containing 1.2 c.c. of tuberculin were sent out on application for cattle to be retested; 100 doses each containing 0.8 c.c. of concentrated tuberculin, 125 doses each containing 1.6 c.c. of concentrated tuberculin and 75 doses each containing 2. c.c. of concentrated tuberculin were sent out for special retesting of cattle previously tested one or more times.

TUBERCULOSIS VACCINES. As in 1908, between 500 and 600 c.c. of tuberculosis vaccine have been made as the experimental work demanded. As shown in 1908, vaccine kept at a low temperature loses considerable of its virulence in three weeks, therefore, no vaccine was used after it had been prepared for three weeks. As the work with the tuberculosis vaccine is yet in the experimental stage, none of the vaccine was sent out, but used entirely by Drs. E. S. Deubler and I. W. Powell, in charge of the experimental work at the farm. The cultures of tubercle bacilli from which the tuberculosis vaccines are prepared were last tested as to their virulence in 1906. It was, therefore, necessary during the past year to again determine the virulence of the tubercle bacilli upon guinea pigs and rabbits, and it was found that the cultures previously tested had lost little or none of their virulence during the past three years. Aside from testing the cultures used in the preparation of vaccines, many other strains were included in these tests.

Heretofore, preparing the vaccine tubercle bacilli were used from bouillon cultures only and it was found by experiment that these moist tubercle bacilli from bouillon cultures of 3— 4 weeks old contained moisture to the extent of 5-6 of the weight of the moist mass of tubercle bacilli and that 1-6 of the total weight represents dry tubercle bacilli. During the year experiments were completed

through which it was learned that the undried tubercle bacilli removed from solid culture media, such as glycerin agar-agar between 3-4 weeks old, contained more dry tubercle bacilli than the moist growth of tubercle bacilli from bouillon cultures of the same age. A factor was computed that may safely be used in the preparation of vaccine with tubercle bacilli from solid culture media as the sum total of all the experiments showed that $\frac{1}{4}$ the weight of the undried tubercle bacilli from 3-4 weeks old glycerin agar-agar cultures represents the amount of dry tubercle bacilli in the quantity weighed.

MALLEIN. 670 c. c. of concentrated mallein have been made. 1,648 doses each containing 0.25 c.c. of concentrated mallein were used for the initial mallein test; 834 c.c. each containing 0.5 c.c. of concentrated mallein were used for the second mallein test; 123 doses each containing 1.2 c.c. of concentrated mallein were used for retesting following the first and second mallein test. The concentrated mallein made during 1907, 1908 and during the past year has been prepared from the stock culture of bacillus mallei kept in the laboratory in a state of high virulence by the frequent passage of the culture through male guinea pigs. This strain has made it possible to prepare a mallein in the use of which practically no poor results have been reported. From the experience obtained in the preparation of mallein during the past three years and the results obtained with its use, the product has not only been proven to be a staple one, but the mallein test as a test can be relied upon to a greater extent than is generally supposed.

ANTHRAX VACCINE. 1227 doses of anthrax vaccine No. 1 and No. 11 for cattle; 21 doses No. 1 and No. 11 for horses and 35 doses No. 1 and No. 11 for sheep were prepared and distributed to veterinarians throughout the State. In one instance it was advisable to follow anthrax vaccine No. 11 with anthrax No. 111, and 27 doses for cattle were sent out for this purpose. From the reports following vaccinations, the results were all favorable with but one exception. The study of vaccine-therapy has shown that an animal's resistance to the infection for which it is vaccinated is considerably lower than it was before vaccination for a short period immediately after vaccination. This period of lowered resistance or "negative phase," following vaccination is generally believed to extend over a period for as long as ten days, and that the highest resistance following vaccination is reached at the end of the 15th day. The one instance in which the results following vaccination were unfavorable occurred upon a farm whose owner was wrongly instructed that it would be safe for him to turn out his cattle upon a strongly anthrax infected pasture, immediately following the last vaccination. It was during this "negative phase" that several of the cattle vaccinated became infected during the short exposure on the strongly anthrax infected pasture, developed anthrax and died. Good results were obtained, however, upon this farm on removing the cattle from the infected pasture, with the administration of anthrax vaccine No. 111, and the lapse of a period of ten days until the good effects of the last vaccination had an opportunity to develop before again turning the cattle out on the infected pastures. From this experience it is strong-

ly recommended that all cattle in infected districts be vaccinated early in the season, at least two weeks before they are turned out upon infected lands.

The strains of anthrax bac. used in the preparation of the vaccine were all thoroughly tested during the year, and found a trifle weak. Before the vaccines were prepared and sent out for the annual Spring vaccinations, the strain used in preparing anthrax vaccine No. 1 was increased in virulence so as to readily kill a white mouse, and the strain for anthrax vaccine No. 11 strengthened in virulence to kill a young guinea pig, which again brought these cultures up to the accepted standard.

SPECIMENS RECEIVED FOR EXAMINATION. During the year 657 specimens were received at the laboratory for diagnosis, of which 34 were specimens of blood, 283 heads of animals, 149 tissues, 102 of pus, 19 of milk, 23 tumors, 7 of chickens, 8 of parasites and 32 miscellaneous specimens. Only 9 of these arrived at the laboratory in such a badly decomposed condition as to make an examination impossible, which is a smaller percentage than the number of decomposed specimens received at the laboratory in 1908. This may in part be accounted for in the persistent manner in which every occasion was used to instruct those who frequently send specimens to the laboratory, what specimens should be sent in any specific case, and how it should be packed if the sender is any distance from the laboratory. Late in the year, additional laboratory specimen shipping cases were purchased and distributed among the veterinarians located a considerable distance from the laboratory. The specimen shipping cases are tin lined square boxes, in which a jar containing the specimen or the specimen itself may be placed in the box and surrounded with ice. Specimens so sent to the laboratory invariably reached the laboratory with some of the ice unmelted, and the specimen as fresh as it was when packed. The senders of specimens not furnished with shipping cases provided by the laboratory, frequently made use of a tin or wooden bucket filled with ice and covered with a piece of burlap—a very satisfactory and by far the better way to send a specimen than by the use of a light wooden box.

Of the diseases for which the specimens received at the laboratory were examined, may be included:

RABIES. 351 heads of animals were examined, of these 66 heads of rabbits and 2 of guinea pigs are included, which were used in the animal inoculation test, used as a part of the examination of doubtful cases of rabies during the year. Of the 66 rabbits, 42 were positive, 23 negative and 1 doubtful. Of the 2 guinea pigs, 1 was positive and 1 negative. Of the 283 heads of animals sent to the laboratory from all parts of the State, 244 were dogs, 189 or 77.4 per cent. were positive, 51 or 20.9 per cent. negative, 2 or 0.8 per cent. doubtful and 2 or 0.8 per cent. so badly decomposed as to make an examination impossible; 18 heads of cows, 15 positive and 3 negative; 10 heads of horses, 6 positive and 4 negative; 5 heads of cats, 3 positive and 2 negative; 2 heads of sheep, 1 positive and 1 negative; 1 head of a hog proven positive and a portion of the brain of three human beings,

all 3 of which were proven to be afflicted with rabies. The method of examination during the past year has been much the same as in 1908. The examination made were continued further in each instance than to merely establish a diagnosis, as all of the structures which may be examined in the diagnosis of rabies were examined in every case and a careful report kept of the result of these examinations. From the amount of material at our disposal, and the records of the examination made in each instance, the following rules have been adopted in the examination and diagnosis of all heads of animals sent to the laboratory.

Specimens of animals that have died a natural death, those not destroyed, are examined and the diagnosis is made as follows:

1. Smears are made and examined for Negri bodies, and as soon as the bodies are found the examination is discontinued and a diagnosis of rabies is made.

2. When Negri bodies are not found in the smears, sections of those structures already examined by the smear method are examined, and if Negri bodies are found the examination is discontinued and a diagnosis of rabies is made.

3. When Negri bodies are not demonstrated, the plexiform ganglion are examined for the Van Gehuchten-Nelis changes, and if absent a negative diagnosis is made.

4. When Negri bodies are not demonstrated and well marked Van Gehuchten-Nelis changes are found, a diagnosis of rabies is made and the animal inoculation test is carried out to verify the diagnosis.

5. Where Negri bodies are not demonstrated and slight proliferation changes are seen in the plexiform ganglion, it is reported that the microscopic examination is negative and that the diagnosis must rest upon the result of the animal inoculation test.

With these specimens of animals destroyed, suspected of having rabies, the examination and diagnosis is made as follows:

1. Smears are made and examined for Negri bodies, and as soon as the bodies are found, the examination is discontinued and a diagnosis of rabies is made.

2. When Negri bodies are not found in the smears, sections of those structures are examined by the smear method, and if Negri bodies are found the examination is discontinued and a diagnosis of rabies is made.

3. In those cases where the brain tissue is entirely destroyed and only the ganglion are obtained, the presence of well marked Van Gehuchten-Nelis changes in the plexiform ganglion is considered sufficient to base a diagnosis of rabies upon.

4. Where Negri bodies are not demonstrated and well marked Van Gehuchten-Nelis changes are found, a diagnosis of rabies is made and the animal inoculation test is carried out to verify the diagnosis.

5. Where Negri bodies are not demonstrated and no proliferation changes are seen in the plexiform ganglion, it is reported that the microscopic examination is negative and that the diagnosis must rest upon the result of the animal inoculation test.

Many experiments in connection with rabies have been carried out during the year, the results of which assisted in formulating the above rules. With the increasing prevalence of rabies throughout the State there is a corresponding increase in the number of heads

of animals suspected of rabies sent to the laboratory, increasing this part of the routine of the examination of these specimens to one of the principal interest of the laboratory.

Included in the tabulation of the species of animals examined for rabies, and three positive cases of hydrophobia in man, all of these were in children in Philadelphia county, with the history of having been bitten by dogs several weeks before symptoms developed. In all three cases, the disease was reproduced in experimental animals inoculated with an emulsion of the brain tissue in each case, and to add additional evidence that the rabies and hydrophobia are one and the same disease, it was necessary to inoculate a series of animals with material of one of the human cases with the following results:

- Rabbit No. 1. Medulla Oblongata. Died in 17 days. Negri bodies found in smears of the brain tissue, Diagnosis-Rabies.
- Rabbit No. 2. Medulla Oblongata. Died in 29 days. Negri bodies found in smears of the brain tissue. Diagnosis-Rabies.
- Rabbit No. 3. Cerebral Cortex. Died in 27 days. Negri bodies found in smears of the brain tissue. Diagnosis-Rabies.
- Rabbit No. 4. Cerebral Cortex. Died in 110 days. Negri bodies found in smears of brain tissue. Diagnosis-Rabies.
- Rabbit No. 5. Hippocampus Major. Died in 1 day. Result of the operation in injecting.
- Rabbit No. 6. Hippocampus Major. Died in 76 days. Negri bodies found in smears of brain tissue. Diagnosis-Rabies.
- Rabbit No. 7. Cerebellum. Died in 12 days. No Negri bodies found in smears of the brain tissue. Diagnosis-Negative.
- Rabbit No. 8. Cerebellum. Died in 40 days. Clinical symptoms of rabies. Diagnosis-Rabies.
- Dog No. 9. Cerebellum. Died in 226 days. Diagnosis-Lobar Pneumonia.
- Guinea pig 10. Cerebellum. Died in 17 days. Diagnosis not established.
- Guinea pig 11. Cerebellum. Chloroformed in 205 days. Normal.
- Chicken (Rooster), No. 12; Chicken (Hen), No. 13. Chicken emaciated at the end of 49 days probably due to lack of exercise owing to close confinement. Chloroformed. No Lesions found.
- Goat No. 14. Cerebellum. Died in 24 days. Negri bodies were found in smears of the brain tissue. Diagnosis-Rabies.
- Calf No. 15. Cerebellum. Died in 24 days. Negri bodies found in smears of the brain tissue. Diagnosis-Rabies.

A bulletin under the title "The Diagnosis of Rabies," is about ready for publication.

TUBERCULOSIS. 52 specimens were received for examination, including specimens of milk, tissues, feces and pus from cattle. Of these, the presence of tubercle bacilli was proven in 26 and not proven in 26. The proof rested upon:

I. Demonstration of tubercle bacilli in smears.

II. Microscopic examination of tissues.

III. Animal inoculation test.

The animal inoculation test was resorted to in all instances where there was reason to believe that the examination was of sufficient importance.

GLANDERS. Eighty-nine specimens were received for examination, including 59 of pus and 34 samples of blood. Most of the blood specimens were sent to the laboratory for the purpose of trying out the glanders agglutination test as to its value in the diagnosis of glanders. The results obtained apparently justify the conclusion arrived at, from the results in the examination of the 379 specimens received at the laboratory in 1908, namely, that the glanders agglutination test is unreliable and not worthy of the name of a test in the examination of an animal for glanders.

The examination of the specimen of pus included in every instance where there was reason to suspect the possible existence of epizootic lymphangitis or an examination of an unstained smear of the pus for the *sacchromyces farciminosus*, and it was shown in several instances than an animal was afflicted with epizootic lymphangitis suspected of having glanders. Following this examination, two male guinea pigs were inoculated in order to observe the Strauss reaction and when necessary the bac. mallei was isolated to strengthen the diagnosis.

Many gross specimens showing lesions as seen in glanders were collected during the year from horses destroyed for glanders and brought to the laboratory as museum specimens. Among the museum specimens, all the stages of lesions of nasal septum, lungs, spleen, liver, kidney and skin of horses affected with glanders are included. The specimens are all properly mounted and now permanently on exhibit in the corridor museum of the laboratory.

EPIZOOTIC LYMPHANGITIS. Eleven specimens of pus received in which it was possible to demonstrate the *sacchromyces farciminosus* in 5; in 3 the organism was not found, and in 3 not enough material was received to make a satisfactory examination. Of the 5 specimens in which the *sacchromyces farciminosus* was demonstrated, one was in a specimen of pus from a horse in Montgomery county, proving the existence of epizootic lymphangitis in the eastern part of the State.

ANTHRAX. Thirty-three specimens from cattle were received, including in most every instance one of the ears. Of these, the anthrax bact. was demonstrated in 14. The examination of the specimens and the diagnosis was made as follows:

1. Microscopic examination of smears of blood from vein of ear or smear of tissue received.

11. Examination at the end of 24 hours of cultures made of the blood or tissues.

The demonstration of bacteria, resembling those of anthrax in the smears, followed by a characteristic growth of anthrax bact. in the cultures made, was considered conclusive in most instances to warrant a diagnosis of anthrax. To exclude error, the motility test of the organism obtained in the culture of the animal inoculation test was relied upon.

HOG CHOLERA. Eight specimens including most all of the internal organs, and in some instances the entire carcass were received. Lesions such as are seen in hog cholera were demonstrated in five of the 8 cases. The blood from the heart of two of these specimens was submitted to the experimental farm and found to contain hog cholera

virus of the most virulent type. The blood of the hogs infected with the virus submitted to the farm was used in hyperimmunizing hogs in the production of hog cholera serum now used in the successful prevention and treatment of hog cholera.

ACTINOMYCOSIS. Only one specimen of pus from a cow was received suspected of being infected with actinomycosis. The *Cladotrichia Actinomyces* was readily demonstrated in smears of the pus.

CHRONIC BACTERIAL DYSENTERY. Although there were no specimens sent to the laboratory for diagnosis, all the animals on a farm in lower Montgomery county have been kept under close observation during the year, and from frequent microscopic examinations of feces of from one to all of the sixty animals on the farm made at short intervals, several cases of chronic bacterial dysentery came under our notice. Material from these animals was studied and facts recorded, to be published through other channels.

FOOT-AND-MOUTH DISEASE. Of the outbreak of foot-and-mouth disease in Pennsylvania of 1908 which was wiped out in January, 1909, an additional collection of muzzles, udders and feet of cattle showing lesions of all the stages of foot-and-mouth disease were collected and immediately placed in a preserving fluid which was also a strong disinfectant and known to readily destroy the virus of foot-and-mouth disease. These, after several weeks, were brought to the laboratory where they have been mounted along with the specimens collected late in 1908, and added to the exhibit in the corridor museum of the laboratory.

SYMPOMATIC ANTHRAX OR BLACK LEG. One specimen, including a portion of the muscle tissue from a calf was received suspected of symptomatic anthrax or blackleg, with which it was possible to reproduce the disease in a guinea pig inoculated. The bacillus of symptomatic anthrax was successfully demonstrated in smears made of the muscle tissue of the guinea pig infected.

MILK. Nineteen sets of samples were received during the year. Of these 11 were sent to the laboratory for estimation of the bacterial content. The conditions under which 10 of the sets of samples were sent, permitted of the estimation of the number of bacteria per cubic centimeter in each instance. One set of samples arrived at the laboratory after considerable delay from the time it was sent, and the number of bacteria per cubic centimeter in this sample was not determined.

Several sets of samples were received suspected of containing tubercle bacilli. In each instance guinea pigs were inoculated with the cream and sediment obtained from 10 c.c. of the sample centrifugized for 15 minutes. The guinea pigs not dead at the end of 8 weeks were destroyed, carefully autopsied and the absence of any lesions of tuberculosis was considered as proof that tubercle bacilli were not present in the milk sample in sufficient numbers to infect guinea pigs. Several samples were submitted to the laboratory with the request that a microscopic examination be made for tubercle bacilli. From considerable experimental work by others and in our own experience, tubercle bacilli are exceedingly difficult to demon-

strate in milk containing large numbers, in smears prepared, stained and examined as smears usually are. In these instances, the sender of the sample was advised to have the cow or cows from which the milk was collected tested with tuberculin, and in the mean time guinea pigs would be inoculated with the cream and sediment of 10 c.c. of the sample. If, at the end of 6 to 8 weeks the guinea pigs are alive, they would be destroyed and autopsied and the report submitted. In this connection the laboratory was called upon to take part in some experimental work to determine whether or not tubercle bacilli were present in the whole milk of a herd of 8 cows near Dalton, Lackawanna county, Pa. There was every reason to believe that this herd was free from tuberculosis, until several calves, the offspring from several of the cows in the herd, were found afflicted with tuberculosis. These calves had been fed with the milk of the herd. Conditions were such so that the cows of the herd could not be tested with tuberculin and, therefore, it was decided that the milk be examined for tubercle bacilli. At first only samples of the whole milk of the herd, i. e. mixed milk of the 8 cows was to be examined, but this plan was preceded by another, that a sample of the morning's milk and evening's milk of each cow, collected in separate bottles, especially provided by the laboratory for this purpose, be taken and examined. A sample of the evening's milk of 7-15-09 from each cow was collected from the udder into one of the sterile bottles. Another sample was collected in a like manner in the morning of 7-16-09. The two separate samples of milk from each cow were received at the laboratory 7-17-09, in one of the regular laboratory specimen shipping cases filled with ice. One guinea pig was inoculated subcutaneously with the cream and sediment of 10 c.c. of each sample of milk, as shown in table No. 1:

TABLE NO. I.

Cow	G. P.	Weight.	Inoc.	Material.	Killed.	Weighed.	Autopsy findings.
No. I,	2214	350	7-17-09	Evening milk 7-15-09	8-24-09	520	No lesions.
	2214	380	7-17-09	Morning milk 7-16-09	8-24-09	490	No lesions.
No. II,	2215	310	7-17-09	Evening milk 7-15-09	8-24-09	430	No lesions.
	2215	290	7-17-09	Morning milk 7-16-09	8-24-09	400	No lesions.
No. III,	2216	270	7-17-09	Evening milk 7-15-09	8-24-09	400	No lesions.
	2216	380	7-17-09	Morning milk 7-16-09	8-24-09	480	No lesions.

In all 16 guinea pigs were inoculated with a portion of the 16 samples of milk from the 8 cows, and at the end of 6 weeks all the guinea pigs were chloroformed and autopsied. All were found free from lesions with the exception of the 2 guinea pigs inoculated with the morning's and evening's milk of cow No. VI.

Before it was known that cow No. VI was giving off tubercle bacilli in her milk, following the collection of the individual samples, a sample of the mixed or whole milk of the 8 cows was sent to the laboratory on separate days as follows 7-17-09, 7-18-09, 7-19-09, 7-20-09, 7-22-09 and 7-23-09. Upon the arrival of each of the separate samples at the laboratory, 2 guinea pigs were inoculated with the cream and sediment of 10 c.c. of each sample, as shown in table No. 11:

TABLE NO. II.

Animals.	G. P.	Weight.	Inoc.	Material.	Killed.	Weight.	Autopsy findings.
Herd, Table No. 1,	2223	280	7-19-09	Milk of herd of 7-17-09	8-24-09	470	No lesions.
	2223	320	7-19-09		8-24-09	480	No lesions.
Herd, Table No. 1,	2228	470	7-20-09	Milk of herd of 7-18-09	8-24-09	680	No lesions.
	2228	470	7-20-09		8-24-09	680	No lesions.
Herd, Table No. 1,	2229	370	7-20-09	Milk of herd of 7-19-09	8-24-09	570	No lesions.
	2229	420	7-20-09		8-24-09	400	No lesions.
Herd, Table No. 1,	2239	440	7-21-09	Milk of herd of 7-20-09	8-24-09	640	No lesions.
	2239	450	7-21-09		8-24-09	660	No lesions.
Herd, Table No. 1,	2245	580	7-24-09	Milk of herd of 7-22-09	8-24-09	790	No lesions.
	2245	440	7-24-09		8-24-09	700	No lesions.
Herd, Table No. 1,	2253	220	7-24-09	Milk of herd of 7-23-09	8-24-09	450	No lesions.
	2258	230	7-24-09		8-24-09	450	No lesions.

In all 12 guinea pigs were inoculated with the 6 separate samples of whole milk, and at the end of 6 weeks all were chloroformed. Not one of the guinea pigs showed any sort of a lesion resembling tuberculosis.

Some very interesting conclusions can, as a result of these experiments, be drawn.

No. I. The presence of tubercle bacilli in a sample of milk can be proven in the inoculation of a guinea pig with a mixture of the cream and sediment of 10 c.c. of a sample.

No. II. That tubercle bacilli must be present in certain numbers to infect a guinea pig.

No. III. The milk of one cow containing tubercle bacilli mixed with the milk of 7 other cows not giving off tubercle bacilli in the milk, sufficiently dilutes the milk of the one cow giving off tubercle bacilli in the milk so that the few tubercle bacilli in a sample of the mixed milk with which a guinea pig may be inoculated, are not in sufficient numbers to infect a guinea pig.

Cow No. VI was killed 8-26-09, and the autopsy revealed no other lesions than one confined to one quarter of the udder. The udder lesion was not seen until after an incision was made through the glandular tissue, which was of a light pink or flesh color, studded with yellow areas made up of yellow tubercles. The yellow areas were less than 1 cm. in diameter and surrounded by pale, apparently normal glandular tissue. Tubercle bacilli were not only demonstrated in large numbers in smears of the caseous material, but the infecting tubercle bacilli were isolated in pure culture from the guinea pigs inoculated with an emulsion of the glandular tissue showing the caseous areas. The tubercle bacilli were isolated for further study in connection with a deeper interest the entire experiment has in another problem.

POULTRY. One live chicken was received at the laboratory and kept for some time and returned to the owner, having shown no symptoms. A loop of the intestine of another was received and found to show a malformation. Tissues from four other chickens were received at the laboratory, in some of which, however, an infectious disease was demonstrated. The liver of a turkey was brought to the laboratory and found to show typical lesions of entero-hypatitis or blackhead of turkeys.

TUMORS. Twenty-three separate pieces of tissue, supposedly tumor masses, were received, removed from dogs, horses and cattle. All were examined with the exception of two, and the following types of tumor were found: soft fibroma, cylindrical adeno-carcinoma, carcinoma simplex, cystic adenoma, squamous epithelioma, lympho sarcoma and round cell sarcoma.

MISCELLANEOUS SPECIMENS. Thirty-two specimens may be included under this heading, of which quite a few were parasites, including: Sclerostomum Equinum and Ascarius Suis; cystic ovary and many specimens of tissues for microscopic examination and several specimens for chemical analysis.

REPORT OF THE EXPERIMENTAL FARM FOR THE STUDY OF DISEASES OF DOMESTIC ANIMALS.

The work upon the Experimental Farm has been under the direct supervision of Dr. E. S. Deubler, who has submitted the following report:

The work at the Experimental Farm, which has been handicapped in the past by the want of suitable buildings, has been greatly strengthened by the erection of a barn where 24 cows, 24 head of heifers and steers, 50 calves and bulls can be well kept, and these buildings are now occupied.

On January 1, 1909, there were 88 head of experimental cattle on the farm, while in January 1, 1910, there are 118 head of cattle, 70 hogs, 18 horses, 120 rabbits and 300 guinea pigs.

The farm, which consists of 200 acres, supplies all the rough food for the stock, the concentrates being purchased. The cattle and hogs and some horses are on experiment. The guinea pigs and rabbits are raised for experimental work at the laboratory.

There has also been built a postmortem laboratory where all autopsies are held, and in connection with this building, a fertilizer plant in which all the dead animals as well as those which are killed are rendered into fertilizer. By thus conserving material which could not previously be utilized and the use of manure from the experimental animals, the fertility of the soil has been greatly enriched.

The soiling system of summer feeding is practiced; only enough ground being devoted to pasture to furnish suitable exercise for the animals. The cattle and hogs for experimental work are mostly raised at the farm. The calves from tuberculous or experimental cows are removed from their dams without being allowed to suckle and are taken to the calf barn where they are raised on the pasteurized milk from the herd. This milk is pasteurized by placing it in a galvanized iron tank when live steam is turned in the milk until it is brought to a temperature of 165 degrees Fahrenheit and kept at that temperature for 15 minutes when it is cooled and fed to the calves and hogs. No cases of milk infection have been found after this treatment and in only two cases in over two hundred, have calves from tubercular dams been found to have what appeared to be congenital tuberculosis. The vaccination against tuberculosis has been carried on according to the methods developed by Dr. Pearson. Experiments at the farm have been continued to show how long the immunity produced by vaccination would last under conditions where the vaccinated animal was constantly exposed to tubercular cows. Control animals were used to test the virulence of this exposure, and some of these animals have died from tuberculosis while the vaccinated animals which were associated with them showed no physical signs of tuberculosis, and do not react to the tuberculin test although they have been exposed to infection for over two years.

The vaccination of young cattle in herds throughout the State has been carried on from the farm, and in 1909, three hundred and twenty-five animals were vaccinated in twenty herds. At the same time, calves have been vaccinated at the farm and after vaccination exposed with controls, to infection to act as a check on the vaccination in herds throughout the State.

The method of vaccination in private herds has been as follows: First. A tuberculin test of all animals which were to be vaccinated was made and only animals passing a satisfactory test were vaccinated. If the herd is known to be badly infected with tuberculosis, the animals to be vaccinated are stabled away from the infected animals or barn, and given the first vaccination which consists of an intravenous injection of a culture of human tubercle bacilli, non-virulent for cattle. A second vaccination with a larger dose is given six weeks later and a third vaccination after another interval of six weeks. It has been found that animals which are undergoing vaccination, and for about six weeks following the last vaccination, do not possess a high degree of immunity and it is necessary to protect them against infection during this period.

It has been found necessary to test every animal before it was vaccinated, because in quite a few cases, calves under six months of age which were being tested preparatory to vaccination have been proven to be tubercular.

In some of the first work done in private herds, the importance of these requirements were not fully realized and in a few cases, vaccinated animals have been found to be tubercular where they had not been tested prior to vaccination or protected from infection during the process of immunization, but in no case where all conditions were favorable has a vaccinated animal been shown to have lesions of tuberculosis in less than two years following vaccination.

Several herds which contain many tubercular animals when the vaccination work was started have been freed from tuberculosis by tuberculin testing and the removal of the reacting animals and the vaccination of young stock.

To January 1, 1910, there have been 1,645 cattle vaccinated divided among 53 owners.

TREATMENT OF TUBERCULAR ANIMALS.

Experiments have been made at the farm in the treatment of cows and young animals which had been shown by the tuberculin test to be tubercular. These animals were given intravenous inoculations of human tubercle bacilli, non-virulent for cattle, and in most cases this treatment appears to have aided in holding the disease in check.

Some reacting dairy cows which were brought to the farm January, 1907, and treated in this manner have kept in good physical condition, bred regularly and produced a large quantity of milk for three years. In some few cases, however, the treatment appears to aggravate the disease and the animals have died of Generalized or Extensive Tuberculosis. This method of treatment might be of practical use where the Bang System is being carried on and it is desired to prolong the life of valuable breeding animals, care being exercised to remove at once such animals as show physical signs of tuberculosis.

EPIZOOTIC LYMPHANGITIS.

Seven horses affected with epizootic lymphangitis were brought to the farm in September, 1908, and have been kept under observation. Some of these horses were treated with physiological doses of Iodide of Potassium administered with the food or water after local treatment had failed to check the disease.

All of these treated horses recovered in so far that all discharging foci were healed, and in cases where there had been a thickening of the leg, this thickening has been decreased and in some cases no

Potassium continued to discharge from the infected areas and being of no economic value were destroyed. An autopsy showed that the disease had penetrated from the superficial lymphatics to the deeper tissues of the affected part.

CHRONIC BACTERIAL DYSENTERY.

There has been a cow associated in the same stable 12' x 12' with a cow in the last stages of chronic bacterial dysentery. This cow with her calf which was born in this stable after the sick cow had died and another calf have been kept quarantined in this stable and yard. None of these animals have as yet showed any symptoms of chronic bacterial dysentery, but Dr. Reichel has made scrapings from the mucous membrane of the rectum and a microscopic examination of these scrapings shows these animals to be infected with chronic bacterial dysentery. These animals are being kept under further observation.

ABORTION.

It has been the practice to bring reacting cows from herds which had been tested to the farm when such cows were needed for the tuberculosis experiments. Some of these animals were found to be affected with abortion as well as tuberculosis and it was decided to treat them for abortion.

On account of insufficient stable room, there was no place where these animals could be isolated, more than to put them in adjoining stanchions in a row. After abortion, the placenta was removed. The external genitalia were washed daily with a 5 per cent. solution of creolin or bichloride of mercury 1 to 1,000 solution. They were then given vaginal douches of warm antiseptic solution, creolin 2 per cent. solution and lysol 1 per cent. solution being usually employed. This douch was given from a wooden pail with a spigot in the side near the bottom to which a 5'- rubber hose about 6 feet long was attached. Five or six quarts of solution were used at each treatment. These douches were given daily for one week or as long as any foul discharge was noticeable, when they were given every other day for two weeks, and then twice a week for a month or longer, if any sign of discharge could be found. The hairs on the scrotum of the bull were clipped and the sheath was flushed with a creolin or lysol solution before and after any service. Aborting cows were not served, until it would have been time to serve them if they had not aborted. By this means, every cow which has aborted has carried her next calf full time when again pregnant.

Some difficulty has been found in getting cows with calf which had aborted and service held off for a long time. The trouble has usually been found to be that the os uteri was occluded on the ovaries cystic. These respective difficulties were overcome by manual opening of the os or rupture of the ovarian cyst through the rectum. This operation requires some special knowledge and is best undertaken by a veterinarian.

HOG CHOLERA.

The preparation of serum for the immunization of hogs against hog cholera has been undertaken in a small way at the farm. The methods used were those which have been developed by the United

States Bureau of Animal Industry. By this method, an immune hog, either one which has survived an outbreak of hog cholera or one which has been artificially immunized against hog cholera, is hyper-immunized by the injection of a large quantity of virulent hog cholera blood into his body. Ten days after this hog has been hyper-immunized, if it is in good condition, it may be bled by cutting off a portion of the tail, the blood collected in a sterile vessel, defibrinated, filtered and preserved with a small quantity of carbolic acid solution when it may be tested and used to immunize other hogs. This defibrinated blood or serum is tested as follows: Four pigs weighing about 30 pounds each which are susceptible to hog cholera are inoculated subcutaneously with a small dose of virulent hog cholera blood. One of these pigs is injected subcutaneously with 20 cubic centimeters of serum. At the same time that the virulent blood is injected, one pig is given 15 c.c. of serum, one 10 c.c. of serum and one no serum. The pig which received no serum should die of hog cholera while the one which received the 20 c.c. should not become sick while the pigs which received the smaller dose of serum may or may not become sick or die.

Serum which has tested well may be used to immunize hogs against cholera by one or two methods:

First, when the serum is given simultaneously with a small dose of virulent blood, or second, the serum may be used alone. By the first method, the immunity produced is lasting. By the second method, the immunity is temporary or passive.

The serum alone is usually used in herds where hog cholera is present at the time, the hogs in such herds having already been exposed to the virus of this disease. The sero-simultaneous method is usually used in herds where the disease has not yet broken out but where there is danger of cholera.

We have produced at the farm a quantity of serum which has given good tests when used against virus, not a single hog which has received the full dose of serum has died. We are now prepared to vaccinate hogs on farms where hog cholera exists or where hogs are exposed to the disease.

Better results in vaccinating against hog cholera are obtained when the vaccination is made early in the disease. Therefore, it is important that all cases of hog cholera or suspected hog cholera should be reported early so that the full benefit of the vaccination may be obtained.

The following well written paper of the discovery and suppression of the recent outbreak of foot-and-mouth disease, which was referred to earlier in this report, was prepared by the late Dr. Leonard Pearson, with the exception of a few sentences which are enclosed in brackets, and is presented here as written by him excepting for a few changes of tense which were made necessary by the fact that a part of the report was prepared before the work was entirely completed.

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A REPORT ON THE OUTBREAKS OF APHTHOUS FEVER IN PENNSYLVANIA IN 1908-1909.

By LEONARD PEARSON, *State Veterinarian.*

THE OUTBREAK AND EXTENT.

About the middle of October, 1908, some cattle in Michigan developed Aphthous fever or foot-and-mouth disease. The method by which these cattle became infected will, no doubt, be determined and disclosed by the United States Department of Agriculture.*

The extent of infection in Michigan was very limited, the disease was of mild type and was confined to the farm upon which it originated and to a few farms and places to which cattle were sent from the source of the disease. Unfortunately, some of the diseased cattle were sent to the stockyards at Detroit, Mich., and thence infection was carried to the stockyards at East Buffalo, N. Y., and by way of Buffalo to Pennsylvania. It appears to be probable that little, if any, infection came direct from Michigan to Pennsylvania, but only indirectly in the bodies of cattle exposed in the Buffalo stockyards.

The occurrence of foot-and-mouth disease in Michigan and in New York was of earlier origin than in Pennsylvania, but the existence of the disease there was not known until a search was made for the origin of the infection that, it was clear, had come to Pennsylvania from Buffalo.

A carload of infected or exposed animals was shipped from East Buffalo, N. Y., October 26th, 1908, to Danville, Montour county, Pa., by J. C. Campbell. These cattle arrived in Danville October 27th; they were sold October 28th, some were delivered to purchasers the same day and others October 29th. It is said that these cattle did not show distinct evidence of disease at the time they were sold, although some were observed to be sluggish and "stiff." The carload was made up of ten steers and nine bulls. The ten steers were slaughtered in Danville and the nine bulls were distributed among seven farmers.

One of the bulls was purchased by Jacob Schultz, whose farm is in Cooper township, Montour county. After this bull arrived at Mr. Schultz's farm it was noticed that it was stiff and that it lacked vigor, but it was considered that this, perhaps, was a result of the journey.

November 3rd a few cows in Mr. Schultz's herd of 40 animals showed some evidence of illness; they did not eat well, they appeared to move with difficulty and there was some excess of saliva about the lips. The next day, more cows were affected in a similar manner and those first affected showed more severe symptoms. The following day, Dr. J. O. Reed, Veterinarian of Danville, was called to see the cattle. He found that approximately half of the mem-

*"The Origin of the Recent Outbreak of Foot-and-Mouth Disease in the United States," by John R. Mohler, V. M. D., and Milton J. Rosenau, M. D., Circular No. 147, U. S. Bureau of Animal Industry.

bers of the herd were affected as described. November 6th Dr. Reed concluded that the cattle in question were affected by foot-and-mouth disease and so reported upon one of the official report-cards,* and, in the afternoon of the same day, by telephone, to the office of the State Livestock Sanitary Board, at Harrisburg. Upon the receipt of this report by telephone Dr. T. E. Munce proceeded to Danville and examined Mr. Schultz's cattle with Dr. Reed, Saturday morning, November 7th. Upon the completion of his examination he quarantined the cattle, and telephoned to me, the afternoon of the same day, a report of the condition found.

Half an hour after receiving this message I took the evening train to Sunbury and proceeded from there early Sunday morning, November 8th, to Danville. All of Mr. Schultz's cattle were carefully examined Sunday morning. It was found that most of the members of the herd, consisting of 38 cows and 2 bulls, were more or less affected. There were erosions in the mouth, upon the tongue and about the lips. Some of the erosions were of bright, red color; and others were coated with a layer of tough yellow fibrin. The cattle were salivating profusely; some of them were making with their mouths a clicking or smacking noise. Nearly all of the cattle exhibited soreness of the feet, as shown by cracking and peeling of the epiderm between the hoofs, in some cases at the top of the cleft in front of the hoofs, and in others about the heels. No vesicles were to be seen upon any of the animals at the time of this inspection. A number of cows had not eaten for several days and the milk flow of the herd diminished to about one-third of the normal amount. Most of the milk cows exhibited peeling surfaces upon the teats and udder. In some of them there was a good deal of inflammation and swelling about the opening of the teat, interfering with the milk flow. In such animals, garget had occurred and the secretion from the udders of some of the cows was thick and purulent. The temperatures of all of the members of the herd was normal or nearly so.

While no disease is known other than foot-and-mouth disease that could produce the symptoms exhibited by the various animals in this herd, the scientific evidence of foot-and-mouth disease could not be regarded as complete without the early or vesicular stage. Realizing the responsibility that rested upon me as State Veterinarian in the matter of making a diagnosis of foot-and-mouth disease—an exotic plague that was not known to exist in North America—and realizing the far reaching consequences of such a diagnosis to the cattle of the United States, when announced officially, I considered it my duty to obtain such complete evidence as to the nature of the disease



Figure 1. The mouth of a cow with aphthous fever. Note the large and small vesicles, the largest of which are below the incisor teeth; and the erosions with sharp borders and dark (red) bottoms on the border of the dental pads.—(From Hutyra and Marek).

Mr. Schultz's herd was immediately placed under stringent quarantine. The removal from the farm premises of all objects that might carry infection was prohibited. The sale of milk had been discontinued several days before, when the first evidence of illness occurred among the cattle. All outsiders were warned away and were prohibited entering the premises occupied by the infected animals.

Dr. Munce and Dr. Reed were requested to ascertain the exact time of arrival of Mr. Campbell's cattle from East Buffalo, the initials and number of the car in which they were shipped, the place of unloading, the disposition of the animals, the possibility of contact with other animals and especially, to determine the present location of all the animals remaining alive of this shipment and to quarantine them, as also all herds and premises they had entered.

Members of the permanent staff of veterinarians employed in the State service were summoned by telegraph to join me at once at Danville.

The next day, Monday, November 9th, I went to Milton in response to a notice from Dr. H. T. McNeal, to the effect that cattle belonging to Mr. Eli Yost, near McEwensville, Northumberland county, were affected by a contagious disease. Before my arrival, Dr. McNeal had decided that these animals were affected by foot-and-mouth disease, and so reported in a letter received in Harrisburg the day of my visit to him in Milton.

It was found that Mr. Yost's herd consisted of 14 cows and 2 bulls. On the 2nd of November, 1908, he had taken home to his farm from a pasture on the farm of Mr. J. M. Montgomery, two miles distant, toward Turbotville, a grade Jersey cow that had been sent to this pasture two weeks before. This cow had been in contact, in Mr. Montgomery's pasture, with cattle that Mr. Montgomery had shipped from East Buffalo, October 26th and that had arrived at his farm October 27th. Mr. Montgomery remembered that this cow, the day before she was removed, had stood alone away from the other cattle and appeared to be sluggish. Nothing abnormal was noticed in regard to the cow during the time she was being driven home excepting that she moved along very quietly and slowly. Mr. Yost's herdsman said that the cow did not eat Monday night, when she was brought home, but Mr. Yost did not observe anything unusual in relation to the animal until the next day, Tuesday, November 3rd. His attention was then drawn to the fact that the cow had some discharge from the eyes and nose and that there was considerable accumulation of saliva about the mouth. The mouth and the muzzle became rapidly more sore and the following day, Wednesday, November 4th, Dr. McNeal was called to see the cow and four other cows which exhibited the following symptoms: the temperatures ranged from 104° to 106° F.; there was an accumulation of frothy saliva about the lips, the cows smacked their lips and sucked their tongues, there was some quivering of muscles, great diminution in the milk flow and loss of appetite for both food and water. Occasionally, one of the animals would raise one of its feet in a spasmodic, jerking way and shake it two or three times before putting it down. Dr. McNeal observed vesicles in the mouth of some of these cows. During the following days, the other cattle in the herd became affected. As the

order of development of disease in this herd is of some interest, as showing the period incubation, the facts as they were gathered will be stated. It will be remembered that the diseased cow (No. 16), was brought home Monday, November 2nd, in the evening, and was then ill. It was placed in the stable with the other cattle. The other cows were observed by the owner to become affected in the following order:

Thursday morning,	cow	No. 4.
Thursday noon,	cow	No. 5.
Thursday evening,	cow	No. 15.
Friday noon,	cow	No. 3.
Saturday morning,	cow	No. 8 and bull 12.
Saturday noon,	cow	No. 10.
Saturday evening,	cows	No. 2 and 7.
Sunday morning,	cow	No. 11.
Sunday noon,	cow	No. 6.
Sunday evening,	bull	No. 13.
Monday morning,	cows	No. 1 and 9.

At the time of my visit, the temperatures of the different members of the herd were as follows:

Cow No. 1,	104
Cow No. 2,	104.5
Cow No. 3,	102.
Cow No. 4,	102.
Cow No. 5,	105.5
Cow No. 6,	105.
Cow No. 7,	104.
Cow No. 8,	102.
Cow No. 9,	105.5
Cow No. 10,	102.5
Cow No. 11,	101.5
Bull No. 12,	101.5
Bull No. 13,	102.5
Cow No. 14,	101.
Cow No. 15,	104.
Cow No. 16,	101.

The symptoms shown by Cow No. 1 were typical and were as follows: the cow was depressed; the coat was rough and staring; there was some quivering of the muscles; the animal had not eaten that morning; upon the middle of the muzzle there was a large vesicle more than an inch in diameter and raised $\frac{3}{4}$ of an inch above the surface and extending almost from nostril to nostril. This vesicle

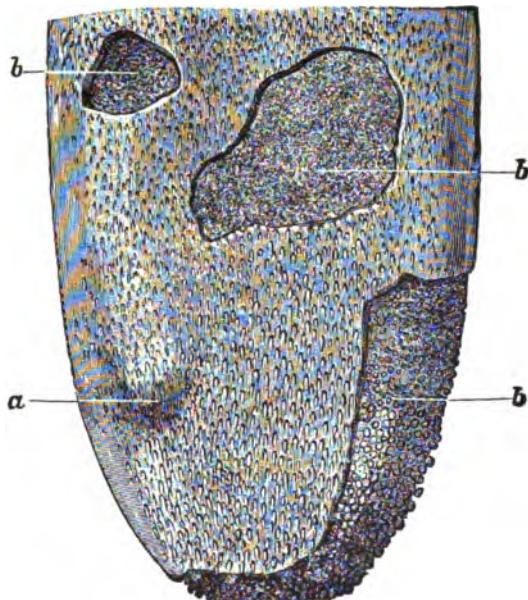


Figure 2. The tongue of a cow with aphthous fever. *a*. A vesicle, consisting of a collection of serum beneath the epithelial layer of the mucous membrane (as a blister). *b.b.b.* Erosions, which have resulted from the tearing away of loosened epithelial layers covering vesicles that occupied these sites. Note the abrupt, sharp borders of the erosions, and the fact that the horny spines of the dorsum of the tongue are lost where the erosions have occurred. (From Ostertag).

led from the stall. The skin between and about the top of the hoofs was reddened. There were no vesicles upon the feet at that time, although vesicles later formed between the hoofs and about the heels.

Mr. Yost's herd was immediately quarantined and precautions were taken similar to those that had been employed in relation to the herd of Mr. Schultz, at Danville.

From Mr. Yost's farm, I went with Dr. McNeal to the farm of Mr. J. M. Montgomery, near Turbotville, Northumberland county. It was found that Mr. Montgomery had received, October 27th, a car-load of cattle from Buffalo. These cattle were purchased at the East Buffalo stockyards Monday, October 26th, and were shipped from there in the evening in N. Y. C. car No. 23060. Of this load 32 steers and heifers were purchased from Messrs. Langdon, McCarthy and Huddleston, and 7 steers and bulls were purchased from Windsor Bros. These cattle were unloaded at Watsontown at 3 p.m.; they were driven to Mr. Montgomery's farm about three miles away, with the exception of two butcher cattle, which were killed at Watsontown. Before these cattle arrived at the farm there were on the place Mr. Yost's cow, two cows belonging to Mr. Montgomery's tenant and two native heifers. During the next few days, Mr. Montgomery sold several steers and young cattle, and, in this way, spread the disease to the farms of his customers, as will be noted later.

At the time of my visit, Mr. Montgomery had on his farm 30 cattle and 44 swine; the cattle comprised two bulls, two cows, eight heifers and eighteen steers. Nearly all of the members of the herd showed typical symptoms of foot-and-mouth disease. This herd was closely quarantined and precautions were taken to prevent the dissemination of disease to other cattle in the neighborhood.

Arrangements were at once made to find the cattle that Mr. Montgomery had sold after the arrival of the shipment from East Buffalo, and to quarantine all cattle that had been exposed to these animals.

After having seen the herds of Mr. Yost and Montgomery, in both of which were cattle exhibiting all stages of foot-and-mouth disease, there was no occasion for withholding the announcement of the official diagnosis. Therefore, as soon as the telegraph office at Milton could be reached, a message was sent to the Commissioner of Agriculture of New York State, advising him that foot-and-mouth disease had been found among cattle recently shipped through the stockyards at East Buffalo. A telegram was also sent to the Chief of the Bureau of Animal Industry of the United States Department of Agriculture to inform him of the occurrence of foot-and-mouth disease among cattle in Pennsylvania, that the source of infection appeared to be the stockyards at East Buffalo, and requested a conference with him to agree upon further measures.

MEASURES ADOPTED BY THE STATE LIVESTOCK SANITARY BOARD.

Dr. P. K. Jones, agent of the State Livestock Sanitary Board, was instructed by wire to go from Pittsburgh to Buffalo and there obtain all information possible in relation to cattle shipments from that place and to points in Pennsylvania, and especially to obtain a list of all shipments that had been made from East Buffalo to any place in this State from the middle of October to the time of his investigation.

The next day, a letter was prepared, which was sent to 853 veterinarians of Pennsylvania to advise them of the occurrence of foot-and-mouth disease among cattle in this State and to caution them to be on the look-out for this disease and to report anything resembling foot-and-mouth disease, by telephone or telegraph to the office of the State Veterinarian at Harrisburg. A notice was prepared and printed Tuesday, November 10th for use in placarding premises where foot-and-mouth disease might be found. (Appendix A.) A quarantine order was also prepared for service on the owners or custodians of infected animals, herds or premises. (Appendix B.)

All of the veterinarians in the regular service of the State Livestock Sanitary Board and a number of temporary employees were engaged during the next few days in the vicinity of Danville and Watsontown in searching for cattle sold by Messrs. Campbell and Montgomery and for cattle that had been exposed to such animals. As the work was new to most of our agents, for there has been no previous outbreak of foot-and-mouth disease in Pennsylvania,* a set of instructions to agents of the State Livestock Sanitary Board engaged in work upon the control of foot-and-mouth disease was prepared and was published November 11th, as Circular No. 14. (Appendix C.)

A meeting of the State Livestock Sanitary Board was called and was held in the office of the Governor November 13th. At this meeting resolutions were adopted as follows:

WHEREAS: Aphthous fever or foot-and-mouth disease has occurred among cattle in the counties of Montour, Northumberland and Union, and it is deemed that cattle in the county of Columbia may have been exposed, and

WHEREAS: Foot-and-mouth disease is a dangerous and highly contagious disease affecting cattle, sheep, goats and swine, and it is of very great importance to the livestock interests of the State and Nation that this outbreak shall be controlled and eradicated, and

WHEREAS: The State Livestock Sanitary Board is charged with the control of contagious diseases among domestic animals in Pennsylvania, and is authorized and empowered by the Act of May 21st, 1895, to establish, maintain, enforce and regulate such quarantine and other measures relating to the movements of animals and their products as may be necessary for carrying out the purposes of the said Act, therefore

IT IS HEREBY ORDERED, FIRST: To prevent the spread of foot-and-mouth disease, and to aid in its eradication, no cattle, sheep



Figure 3. The head of a cow with aphthous fever.



RESOLVED: That the State Veterinarian is hereby authorized to request and accept the co-operation of the Chief of the Bureau of Animal Industry in the work of prevention, suppression, control and eradication of foot-and-mouth disease in Pennsylvania, in accordance with such a plan and upon such terms as will contribute to the scope and efficiency of the work of this Board.

RESOLVED: That the Secretary of the State Livestock Sanitary Board is hereby authorized to appoint as agents of this Board such employes of the United States Bureau of Animal Industry engaged in the control of diseases of animals in Pennsylvania as are recommended for such appointments by the Chief of the Bureau of Animal Industry: Provided, however, that employes of the United States Bureau of Animal Industry appointed as agents of the State Livestock Sanitary Board shall receive no compensation from the State funds for service as agents of this Board.

RESOLVED: That the Secretary of this Board is hereby authorized to purchase such supplies and materials and to employ such agents as may be necessary to carry out the provisions of the Act of May 21st, 1895: Provided, that the expense incurred shall not exceed the amount of money now available for such purposes.

The following rules and regulations were also adopted by the State Livestock Sanitary Board:

The State Veterinarian, the Deputy State Veterinarian and the agents of the Board, under the direction of the State Veterinarian, are authorized to carry the following rules and regulations into effect:

Upon the discovery of foot-and-mouth disease, it is required that a quarantine shall at once be established of the affected animals and of all cattle, sheep, goats and swine that it is believed may have been exposed. Premises or objects occupied or contaminated by affected animals or their products must be quarantined, and premises may be quarantined where there is reason to believe that there may be danger of contamination by foot-and-mouth disease.

1. Cattle, sheep and goats and swine under quarantine on account of foot-and-mouth disease must be kept absolutely and wholly separate and apart from all other animals and all other animals must be kept wholly apart from quarantined animals.

2. The quarantine is extended to animals other than those originally quarantined, if they are permitted to come in contact with quarantined animals or to enter quarantined premises.

6. If domesticated animals, dogs, cats, poultry or pigeons are kept at liberty or are allowed to go free so near quarantined animals or premises they constitute, in the estimation of an agent of the State Livestock Sanitary Board, a menace to the efficiency of the quarantine, such animals may be confined and placed under quarantine.

7. Milk from diseased or exposed cows or milk produced in or on quarantined premises shall be placed in milk cans, or other receptacles that have covers that fit tightly. Formaldehyde shall be added to such milk in the proportion of one pint of formaldehyde to thirty quarts of milk. The cover shall then be placed on the can or receptacle and the milk and formaldehyde mixture shall remain in the cow stable, undisturbed, for not less than eight hours, after which it is to be poured into a pit dug in the manure pile and covered over with manure. Agents of the State Livestock Sanitary Board may authorize other safe methods for disposing of such milk.

8. There shall not be removed from quarantined premises, without specific permission in writing from an authorized representative of the State Livestock Sanitary Board, any material, article or thing that is likely to or that may convey contagion, and, in particular, there shall not be removed from such premises any milk or milk products; diseased, exposed or quarantined animals, hay, straw, fodder, grain or other feed, manure, stable or milk utensils.

9. Horses that are to be used must be kept in a stable separate from the buildings and premises under quarantine. Before removal to such stable the horses shall be thoroughly cleaned, their feet and legs shall be disinfected and the halters and harness shall be disinfected.

10. Persons caring for quarantined animals must not convey or permit the conveyance, from the quarantined premises, of articles, materials or things that have been in contact with, that are contaminated by or that may have been contaminated by diseased animals.

11. All unauthorized persons are forbidden to enter quarantined premises or to come in contact with diseased or exposed animals, or with any object or thing that may have been contaminated by or from such animals.

WHEREAS: The occurrence of foot-and-mouth disease among domestic animals in Pennsylvania, constitutes an emergency that will necessitate unusual expenditures by the State Livestock Sanitary Board, be it

RESOLVED: That the Auditor General and the State Treasurer are requested to make available for immediate use such funds appropriated to the State Livestock Sanitary Board as may properly be employed in the control of this disease.

Figure 5. A cow with aphthous fever or foot-and-mouth disease.



the receipt of messages and reports and for the dissemination of orders and information to agents of the State Livestock Sanitary Board and to veterinarians and cattle shippers.

Wednesday, November 11th, Dr. A. D. Melvin, Chief of the Bureau of Animal Industry arrived at Danville, accompanied by Dr. J. R. Mohler, Chief of the Division of Pathology and Dr. R. P. Steddom, Chief of the Inspection Division. Preliminary arrangements were made whereby the United States Bureau of Animal Industry should co-operate with and assist the State Livestock Sanitary Board. Dr. Melvin telegraphed instructions to a number of the veterinary inspectors of the Bureau of Animal Industry to repair to Danville. Dr. Samuel E. Bennett, Chief Inspector at Chicago, was selected to remain in local charge of the federal inspectors; he arrived in Danville November 13th. Dr. Melvin proceeded from Danville to Buffalo, New York, and returned from Buffalo to Sunbury November 15th. At a conference held that day it was arranged that Dr. Bennett should represent Dr. Melvin and his Department in work pertaining to the eradication of foot-and-mouth disease in Pennsylvania, and that the United States Department of Agriculture should bear two-thirds of the total cost of expense incurred in connection with the appraisal, destruction and burial of diseased or exposed animals and two-thirds of the cost of cleaning and disinfecting the premises contaminated by animals afflicted with foot-and-mouth disease. Furthermore, it was agreed that the veterinary inspectors of the Bureau of Animal Industry operating in Pennsylvania, should be appointed temporary agents of the State Livestock Sanitary Board, so that they might have authority to enter premises to inspect, appraise and destroy animals, and that the federal inspectors should report to, and be subject to the regulations of the State Livestock Sanitary Board. When these arrangements were made, the work of destroying and burying affected herds and of disinfecting premises that they had occupied, was started.

THE STAMPING-OUT METHOD.

The stamping-out method of dealing with this outbreak was decided upon and was recommended by me as soon as the diagnosis was established, but on account of the large amount of money that would be required, the practical work of destroying the infected herds did not begin until we had assurance as to the proportion of expense that would be assumed by the United States Department of Agriculture. There was no hesitation on the part of the federal officials in adopting this method, for the plan of operation was essentially the same as that which had given such thoroughly good results in the eradication of foot-and-mouth disease in New England in 1902-03, and is the plan that was placed in operation at that time by Dr. D. E. Salmon, then Chief of the Bureau of Animal Industry.

The stamping out method for dealing with foot-and-mouth disease had its origin in Denmark and has been used to a considerable extent in England and other countries where it has appeared to be possible, on account of the limited prevalence of foot-and-mouth disease, as at the beginning of an outbreak, to control it by this method. This method has never been attempted after foot-and-mouth disease has gained an extensive foothold in a country, on account of the enormous

cost of compensating owners of condemned cattle; but the experience of European countries that have endeavored to control this disease by quarantine and disinfection alone, without the complete and immediate eradication of all infected places, has shown the great risk that attends this latter method, and the hopelessness of it, excepting where quarantine restrictions can be enforced with the utmost severity and for long periods of time. There is now no doubt in the minds of those who have studied veterinary sanitary problems as to the wisdom of fighting outbreaks of foot-and-mouth disease by the stamping out process when the disease is of limited distribution in a country. The Chief of the Bureau of Animal Industry and his associates all agreed as to the propriety of using this method. They did not, however, as a result of the experience in New England in 1902-3, consider it necessary to purchase and own all of the coarse forage, hay and straw on infected premises.

As a result of the letter that was mailed to veterinarians November 11th, and of a circular letter to veterinarians and farmers that followed it, and the wide newspaper publicity given to the outbreak of foot-and-mouth disease in Montour and Northumberland counties, veterinarians and farmers throughout the State were all looking carefully for the first evidence of the malady. In quick succession, reports of animals or herds infected by foot-and-mouth disease, came to the office of the State Veterinarian at Harrisburg from upper and lower Lehigh county and from Lancaster, Montgomery, Chester, Delaware, Snyder and Clinton counties. Infected animals were also found in counties near the above named, as: Juniata, Lycoming, York, Union, Philadelphia and Dauphin. In every outbreak, the infection was traced, without a break in the evidence, to cattle shipped from East Buffalo.

There was very little extension of foot-and-mouth disease from herds infected within the State. It should be understood that the disease did not start at Danville and from that place spread to other parts of Pennsylvania; on the contrary, the disease was dropped down from Buffalo into eight separate and distinct districts in different parts of the State. There was no spread of foot-and-mouth disease from one general region to another within the State, and there was very little spread within a local district after the fact of infection in that district became known.

Whenever a herd was found to be infected with foot-and-mouth disease, the first step was to quarantine the herd and the premises by the service of a State Order of Quarantine, after which inquiry was at once made as to the source of infection. In all but a very few cases, which are shown in the detailed statement that follows, it was found that infection had been brought to the herd either by cattle shipped from East Buffalo or by cattle that had been in association with such animals, or that had occupied premises contaminated by such animals. In one instance, in Clinton county, the disease was carried by infected swine which, in turn, were infected by cattle from East Buffalo. In five instances, the disease was carried on the clothing of persons, and in four instances the mode of infection was not determined, although, in each of these, infected animals had been a short time before in the immediate neighborhood.

Figure 6. The examination of the mouth and tongue of a cow with aphthous fever.



In addition to inquiring into the source of infection, a thorough investigation was always made to determine whether any animals or any products that might convey infection had been removed from the farm after the occurrence of disease upon it. When it was found that infection was brought to the farm by certain animals purchased, the seller's herd was placed in quarantine and the animals that had been distributed by this individual were traced. In most instances this was comparatively an easy task, as, for example, in the case of the nine bulls brought from East Buffalo and sold by Mr. Campbell. In this instance, it was found that seven herds were infected directly and one indirectly by this shipment. In other cases, the task was not so simple, as, for example, in relation to a shipment of 35 cattle from East Buffalo November 2nd, to Lehigh county by A. J. Bean. These cattle were unloaded at Vera Cruz, November 4th; they were driven three miles over the public highway to Limeport, where they were sold November 6th to sixteen farmers and two butchers. Nine herds became infected by these cattle. The herds of seven purchasers were not infected and two lots of cattle were butchered in apparent sound condition.

In the case of the cattle brought from East Buffalo that were sold by Evans C. Walker, Norristown, the condition is somewhat more complicated. These cattle, 22 cows and 4 calves, arrived in Norristown November 4th and were held on Mr. Walker's premises until November 11th, when they were disposed of by public sale. During this time, the cattle were not in normal condition and they were examined by Dr. H. O. Dengler, a practising veterinarian in Norristown. Dr. Dengler observed that a number of them had abnormally high temperatures and were not well. When these animals were sold November 11th, they were associated with twenty other cattle and six goats. Nearly all of the animals disposed of at this sale carried the infection of foot-and-mouth disease from Mr. Walker's stable to other premises. This fact, however, did not become known to the authorities until November 19th, when foot-and-mouth disease was reported by Dr. Mathues in the herd of Ellis Brous near Tanguay, Delaware county, which was found to have become infected (by way of the Kelly farm), by cattle sold by Mr. Walker. In the meantime, on November 18th, Mr. Walker had held another sale and had distributed 49 cattle. These cattle were handled through his undisinfected pens, stalls and stable, and many of them subsequently developed foot-and-mouth disease. Through these sales, infection was carried directly to fifteen herds and indirectly to twelve other herds. All of the infection of foot-and-mouth disease that was distributed in Montgomery, Chester, Delaware and Philadelphia counties was disseminated from Mr. Walker's premises in Norristown, Montgomery county.

It is most unfortunate that the fact that the cows from East Buffalo were infected by foot-and-mouth disease was not made known during the six or seven days they were in Mr. Walker's custody. As a result of failure to discover or to report that these cattle were so affected, it became necessary to place quarantine restrictions on three counties that, otherwise, it would not have been necessary to quarantine. These four counties with which infection was carried by this shipment comprise 14,811 farms, every one of which was subjected

to burdensome restrictions, the necessity for which should have been avoided. An extensive cattle business in these counties was suspended and, for a time, destroyed. Twenty-five farmers and cattle owners lost their herds and a number were temporarily without means of earning a livelihood. Expense to the Federal and State governments amounting to tens of thousands of dollars was incurred, and the authorities were subjected to a great amount of woriment and stress, all through failure to recognize the existence of foot-and-mouth disease in these animals that were under observation for a week at Norristown.

There is no occasion in Pennsylvania for a veterinarian to remain in doubt or to take individual responsibility in relation to the diagnosis of a new, strange or vague disease. It is always possible, in such cases, through the State Livestock Sanitary Board, to obtain counsel and assistance without cost, and promptly. If it had been reported to the proper authorities before these cattle were sold and distributed, that they had foot-and-mouth disease, direct and indirect losses, the amount of which it is impossible to estimate with accuracy, but which probably amounted to \$250,000, might have been avoided. This incident illustrates, and emphasizes, the grave responsibility of veterinarians in dealing with unfamiliar conditions and the care that it is necessary that they shall exercise in relation to handling diseases that they do not understand, and that may be contagious.

The first report of foot-and-mouth disease in Clinton county was found by Dr. Good among cattle belonging to Mr. R. M. Hanna, near Lock Haven. Adjoining Mr. Hanna's premises, there is a slaughter house belonging to F. L. Winner, that is used almost exclusively for the slaughter of cattle shipped from East Buffalo. Between the 19th of October and the 9th of November, 103 cattle shipped through East Buffalo, many of them from Michigan, had been killed at this slaughter house. When the slaughter house was visited it was found that there were eighty hogs on the premises and about thirty showed marked evidence of foot-and-mouth disease. It appeared to be probable that the infection was in some way carried from the slaughter house premises to the adjoining premises of Mr. Hanna, although the exact mode of transmission was not determined. From the premises of the slaughter house of Mr. Winner and from Mr. Hanna's farm, the infection was carried to three other farms in the neighborhood.

The outbreak of foot-and-mouth disease that occurred in Snyder county and the disease that extended into the neighboring counties of Juniata and Dauphin resulted from two shipments of cattle from East Buffalo, N. Y., to Wm. Troutman, of Meiserville. Mr. Troutman

DEPARTMENT OF AGRICULTURE

the line of Snyder country in the northern part of the state. One of these purchases resulted in the infection of one herd to that of the original purchase herd. This infected herd, resulted in the infection of the other herd on the same premises. The second herd of cattle obtained in a similar way, Mr. Troutman's shipment of November 1st, was received in Middleburg in sound condition. Some of these animals were affected with foot-and-mouth disease while in transit, prior to arrival in Middleburg. The cattle were kept in pens at stockyards at East Buffalo, or they may have been held in the holding chute in Middleburg, or some of them were held in pens which had been occupied over night by infected animals. A part of these cattle were sold in Middleburg, and the remainder retained on Mr. Troutman's farm. The cattle were sound in every instance, but the disease followed the animals infected by the purchased animals.

The herds in which foot-and-mouth disease has been found may appear to have been infected by cattle from the same or other stockyards. Fortunately, most of the cattle came to the state from the West by way of Pittsburgh, and were in sound condition, and it appears from the evidence available that all of these cattle were sound when received at the Lancaster stockyards at any time during the month of October. Between the 19th of October and the 23rd of October, 1924, 1,000 head of cattle were received from Eastern stockyards by four commission men. Many of these cattle came from Michigan, by way of the Detroit stockyards, and were from the western counties in Michigan. It happened that two of these commission men sold cattle to go into all of the herds which were subsequently infected in Lancaster county. Infection was traced to the Lancaster county by means that could not be determined. One of these three herds was on a farm only a mile and a half from the stockyards, and alongside of the railroad; the others were a mile away, across country from this one. It appears that seven herds became infected by animals purchased at the stockyards. In each case of cattle distributed infection outside of the stockyards by roads or premises first infected, and this spread infection to six herds.

As the amount of infection at the Lancaster stockyards could not once be determined, it was deemed advisable to thoroughly clean and disinfect the entire yards. The work of cleaning and disinfecting was commenced November 23rd and occupied two weeks. The work was very thoroughly done by the stockyard company. In order to expedite the work, the first supply of disinfectants was furnished by the State Livestock Sanitary Board, but the material and labor to complete the work were supplied by the stockyard company. In order

across the line of Snyder county, in the northern part of Juniata county. One of these purchases resulted in the infection of a herd in addition to that of the original purchaser and another purchase (Bower), resulted in the infection of one other herd of two cows on other premises. The second lot of cattle shipped from East Buffalo by Mr. Troutman (shipment of November 9th), probably arrived in Middleburg in sound condition. None of these animals was observed to be affected with foot-and-mouth disease until nearly a week after their arrival in Middleburg. The cattle may have been exposed at the stockyards at East Buffalo, or they may have been exposed at the unloading chute in Middleburg, or upon the pasture field of Mr. Kuster, which had been occupied over night by the lot of November 3rd. A part of these cattle were sold to five purchasers and some were retained on Mr. Troutman's farm. The cattle sold carried infection in every instance, but the disease did not spread beyond the herds infected by the purchased animals.

The herds in which foot-and-mouth disease occurred in Lancaster county appear to have been infected by cattle brought from the Lancaster stockyards. Fortunately, most of the cattle sold at Lancaster come from the West by way of Pittsburg, where there was no infection, and it appears from the evidence available that only a few pens at the Lancaster stockyards at any time contained diseased cattle. Between the 19th of October and the 10th of November, shipments of cattle were received from East Buffalo at the Lancaster stockyards by four commission men. Many of these cattle came from Michigan, by way of the Detroit stockyards. Some were from infected counties in Michigan. It happened that these four commission men sold cattle to go into all of the herds that were originally infected in Lancaster county. Infection was carried to three herds in Lancaster county by means that could not be definitely traced; one of these three herds was on a farm only a mile and a half from the stockyards, and alongside of the railroad; the others were a mile away, across country from this one. It appears that seven herds became infected by animals purchased at the stockyards. Only one lot of cattle distributed infection outside of the stockyards beyond the premises first infected, and this spread infection to six herds.

As the amount of infection at the Lancaster stockyards could not at once be determined, it was deemed advisable to thoroughly clean and disinfect the entire yards. The work of cleaning and disinfecting was commenced November 23rd and occupied two weeks. The work was very thoroughly done by the stockyard company. In order to expedite the work, the first supply of disinfectants was furnished by the State Livestock Sanitary Board, but the material and labor to complete the work were supplied by the stockyard company. In order that the work might be started promptly, a steam disinfectant pump belonging to the State was loaned to the stockyards company, and was used for several days until it was replaced by a larger pump supplied by the company. The cleaning of the stockyards preparatory to disinfection was very thorough and cost about \$7,000.00, exclusive of loss of business.

The Lancaster stockyards are equipped to handle 6,000 cattle at one time. There are more than 200 pens. Most of these pens are located on the north side of the Pennsylvania railroad. There are

many streets and alleyways through the stockyards and three scales, with pens adjoining. There are also buildings for the storage of hay and straw, a corn crib, a two horse stable and a two-story cow stable and several fine buildings. On the south side of the railroad tracks, there are other pens and alleyways. The two sets of pens are connected by a tunnel beneath the railroad tracks. There are long unloading platforms sufficient to accomodate two trains on each side of the railroad. At the west of the yards, on the north side of the railroad, there is a series of pens for sheep and hogs. Most of the pens in the Lancaster stockyards are partly covered with shed roofs. The uncovered portions of some of the pens are paved. Most of the streets and alleyways are paved with brick or stone.

In cleaning the stockyards, all manure was removed; this was piled up on a plot of ground outside of the stockyards and east of it. The manure was mixed with chloride of lime as it was piled. Afterwards, the mangers and racks were cleaned and the ground was scraped with shovels and hoes. In many places, the covering of the earthen floors was removed with picks. All of this material was shoveled into carts and was piled with the manure. The fences, feeding troughs and the floors of the pens and of the streets and alleyways were thoroughly swept. Accumulations of manure and dirt on the posts, fences, etc., were scraped off.

After this thorough cleaning, the premises were disinfected. The disinfectant solution used was carbolated lime wash—a thin whitewash, to which was added sufficient "straw-colored carbolic acid," (cresol), to make a five per cent. solution. The distribution of this material was accomplished by the use of pumps. In the beginning hand pumps were used but it soon became evident that it would not be possible, without a very great, and avoidable expenditure of labor and time, to complete the work in this way; therefore, I devised a plan for distributing the disinfectant more rapidly with a steam pump. I had a small steam pump mounted on a low hand truck; this was connected by steam hose with the boiler of a traction engine. Two lines of hose, each 120 feet long, led from the steam pump. The pump was fed from a cask containing the disinfectant solution. From two to three barrels of solution were required for each cattle pen. The solution was conveyed to every portion of the surface of the fences and fittings of the pens; it was also carried into cracks and crevices between boards and was in amount sufficient to thoroughly drench and wet every exposed surface. This pump was afterward replaced by a larger pump that supplied three lines of hose.

There was, at first, some difficulty in mixing the disinfectant fast enough to keep the pump supplied. A very successful plan for accomplishing this was worked out by Dr. W. G. Benner. He arranged for the construction of an elevated vat in which the lime wash and carbolic acid could be mixed. The mixture was drawn from this vat into a tank on a wagon, which was taken to the place where the disinfection was going on, and the mixture was pumped from the tank wagon. While one wagon was being emptied another was being filled. In this way, the pump was kept continually supplied, with the expenditure of a minimum amount of labor.

After the stockyards had been cleaned and disinfected, they were reopened for business. Under the restrictions established by the Secretary of the United States Department of Agriculture with re-

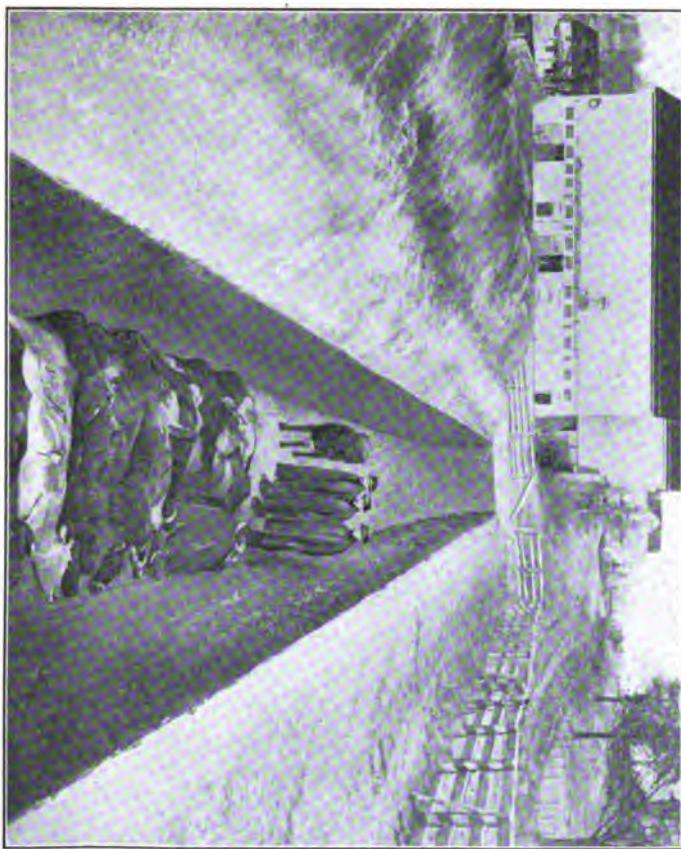


Figure 9. A pit in which a herd of fifty-five cows was buried. The cattle were led down the incline and were then shot and bled in the pit. Afterwards they were disemboweled, the hides were slashed and they were covered with quick lime.

Figure 8. A pit seven feet wide
deep and twenty-four feet long, fo-
of fourteen cattle and six pigs,
were shot on the edge of the pit and
tolled into it, where they were bl-



lation to stockyards in quarantined states carrying on interstate trade, it was provided that the stockyards should receive no local cattle, but only such cattle originated from unquarantined territory in this or other states and that had been shipped in disinfected cars.

METHOD OF DEALING WITH THE HERD.

The method of dealing with a herd in which foot-and-mouth disease had been found was as follows: The herd was immediately placed in quarantine by serving upon the owner or custodian a properly executed State quarantine blank, as shown by Appendix B. The premises were then placarded by tacking to gates, doors and walls a warning notice, as shown by Appendix A. The farmer was instructed as to the nature and the necessity for the severe precautions that were ordered. The custodian of the cattle was required to keep a set of overalls and rubber shoes to wear while among the cattle and to leave this clothing at the door or gate leading from the infected premises, and to wash his hands with a disinfectant. If horses had been kept in the same building with cattle it was required that those that were to be used on the road should be taken out and stabled elsewhere. Usually it was possible to build temporary stalls in a wagon shed or in some other building entirely apart from that occupied by the cattle. Before the horses and their harness were permitted to be moved from the infected premises to their new quarters, it was required that they should be cleaned and disinfected under the supervision of a State or federal inspector. Persons who came in contact with the infected animals or infected premises were not permitted to leave the farm until after they had bathed and changed their clothing, or until after the clothing that they had worn among the cattle had been disinfected by immersion in a solution of bichloride of mercury, or by fumigation with formaldehyde.

Immediate arrangements were made for the appraisal of all infected and exposed animals. In many instances, the appraisals were made by an agent of the State Livestock Sanitary Board and a veterinary inspector of the Bureau of Animal Industry, in agreement with the owner. In those cases, however, where this could be done without serious loss of time, or where there was difficulty in reaching an agreement that was believed to be equitable, an official appraiser was appointed. An effort was made in every case to arrive at the actual market value of the appraised animals. All of the exposed cattle on the farm were appraised, whether they exhibited symptoms of foot-and-mouth disease or not. The same rule was adopted with regard to sheep and goats. In respect to hogs, it was arranged that if these had been in contact with cattle, in the barnyard or elsewhere, that they should be appraised and destroyed and buried with the cattle. If, however, the hogs were kept in a separate building and had not been in contact with the cattle or with the premises that the cattle occupied but had been exposed only by the passage of people between the piggery and the cow stable, and if all of the hogs were free from evidence of foot-and-mouth disease, permission was given to slaughter the hogs on the farm and to use the meat, after the head and feet had been removed. It was considered that if the head and feet were removed and the surface of the hog was thoroughly cleaned by scalding, that there could be no possibility of the transfer of infection,

and no harm resulted in any case from this practice. It should be stated, that permission to dispose of hogs in this way was not made use of excepting in a few instances, and then only to obtain pork for local consumption. In nearly every case the hogs were killed with the cattle.

Instructions were given to the agents of the State Livestock Sanitary Board, and similar instructions were given by Dr. Bennett to the veterinary inspectors of the Bureau of Animal Industry acting under temporary appointment as agents of the State Livestock Sanitary Board, to arrange, as soon as foot-and-mouth disease was diagnosed, for the excavation of a trench in which to bury the condemned animals. An effort was made to locate the trench near the stable and on the same side of the road. Usually the location was within one hundred yards of the cow stable. The trenches were dug seven feet wide and seven feet deep, and long enough to accomodate all the animals to be buried, allowing from eighteen to twenty-four inches in length for each animal, depending upon their size. For a herd of thirty cattle of varying sizes a trench of fifty feet long would probably be sufficient.

In destroying the cattle, they were usually led to the side of the trench, where they were shot and rolled into the trench, and then bled. The abdomen was opened and the contents of the paunch was drawn out, in order that the carcasses might be stored more compactly. Hides were slashed, to spoil them. An effort was made to have but one layer of animals in the bottom of the trench. Small animals were deposited in the spaces between the larger ones.

It was unsafe to attempt to lead some animals that were cross or were not accustomed to being handled. Such animals were shot in the stable and were drawn out by horses, or they were led out behind a wagon. After the killed animals were all in the trench, they were covered with freshly burned lime. From two to three bushels of lime was allowed for each carcass.

The laborers engaged in this work were supplied with overalls and caps, which were afterwards thrown into the trench and covered over. Their shoes were disinfected. The other clothing was fumigated on the wearer, under a fumigation cape. The trail over which the cattle were led from the stable to the trenches was, in some instances, burned over after it had been sprinkled with kerosene and strewn with straw. If this could not be done, the trail was scraped and the earth was thrown into the trench, or it was thoroughly sprinkled with disinfectant, or was spread over with lime.

DEALING WITH THE INFECTED PREMISES.

After the animals were destroyed, the infected premises were closed until they could be reached by the disinfectors. The work of cleaning preparatory to disinfection was organized by Dr. Bennett whose



Figure 10. To show the clothing worn by inspectors working on foot-and-mouth disease and their method of cleaning their clothing before leaving infected premises. Note the rubber hats, coats, gloves and boots. One inspector has been sponged, the other is being sponged, with a 1 to 500 solution of bichloride of mercury.

dehyde, cresol or chloride of lime. The stable was thoroughly cleaned out. This necessitated the removal of such interior fittings as mangers, hay racks, stall partitions and floors of wood or loose material. The woodwork that was not removed was well cleaned by scrubbing and scraping. Most of the stables had hay lofts or hay mows, the floors of which constituted the ceiling of the stable. In some cases, although rarely, these ceilings were made of well joined tongued-and-grooved boards. Usually, they were made of boards laid loosely, with spaces between, and sometimes of poles between which hay projected and hung down into the stable.

The tops of the hay mows were thrown off and the sides were raked or cut down, thus removing all of the loose and possibly contaminated exterior. All wood, hay, etc., removed was burned. Where hay projected through the floor of the mow, the loose hay was pulled out with hooks and later, in some cases, formaldehyde solution was pumped into the exposed hay or straw by inserting the nozzle of the hose through the crevices between the boards or poles into the mass of hay or straw lying at the bottom of the mow.

After cleaning, disinfecting was accomplished by the liberal use of formaldehyde solution (5 per cent.), cresol solution (3 per cent.), or carbolic acid solution (5 per cent.). In some places, chloride of lime was used for a part of the work. It was customary to add the formaldehyde or carbolic acid to whitewash. This is good practice because the disinfectant shows where it has been applied, and there is no danger that any part of the surface that should be reached by the disinfectant may escape. Saponified cresosol cannot be used in this way with lime. On account of the large amount of mixture that is required to disinfect some places (1,000 to 2,000 gallons), it was difficult to do the work easily when only hand pumps were used. Therefore, I equipped and placed in use three steam pumps which were found to be of great advantage, when properly handled.

It was recognized that steam pumps would need skillful attention and so a careful man was selected to take charge of each one. A steam pump is not a practical disinfection apparatus if it is in the hands of an incompetent or careless person as the mechanism may fall into disrepair, or the boiler may be injured, and so delay the work. This, however, did not occur in relation to any one of our steam pumps. We found that the most convenient way of working the steam pump was to have it mounted on a small hand truck and to use it in connection with a traction engine, as was done at the Lancaster stockyards. This obviates the movement of a heavy truck from one part of the State to another. It is possible to hire a suitable traction engine, by the day, in almost any farming community. The pumps were provided with two outlet pipes so that each could supply two lines of hose. With such an equipment, the rapidity with which the work of disinfection was carried on was measured only by the ability of the helpers to supply the disinfectant mixture.

An advantage of a steam pump over a power pump operated by a gasoline engine is that exhaust steam can be used for heating and keeping hot the disinfectant solution, thus making it much more efficient in cold weather.

After having disinfected the manure pile, the stable and the barn surroundings were disinfected, as well as the outside of the building to a height of about eight feet, the barnyard walls, fences and the neary-by paths and ground surfaces over which cattle or people had walked.

Formaldehyde gas was used for disinfection in some places, and it is believed to be very suitable except for the danger involved, when the gas is liberated by the use of permanganate of potash. In fumigating a stable, it is necessary to close it as tightly as possible to prevent the waste and escape of gas. This can be done effectively, and relatively cheaply, by using a billposter's equipment and by pasting wide strips of paper around windows, doors and other cracks and openings. The entire outside of the building may thus be prepared. In fumigating stables with formaldehyde, care is taken to dampen the interior by spraying with water, as the formaldehyde gas is of very limited value. About 50 per cent. of material is used in excess of the normal amount of 20 ounces of formaldehyde solution and 16 2/3 ounces of permanganate of potash to each 1,000 cubic feet of air space.

Three hand pumps were supplied by the State for disinfection purposes, for use in places that were not readily accessible and to which it would not pay to ship or move a steam pump. The Bureau of Animal Industry had in use some hand pumps and, later, two steam pumps.

Considerable hay, straw and corn fodder were burned. This was always done where the conditions were such as to denote that these materials might have become infected and where they were piled or stored that the possibly infected portion could not be entirely removed. In one case, diseased cattle had been permitted to run in the corn field and to eat from and upset the bundles and shocks of corn fodder. It thus became necessary to burn the fodder in the field as well as several loads that had been taken into the barn.

The hay, straw, corn fodder, stable fittings or other material that it was necessary to destroy were appraised at market prices and an estimate was made as to the cost of labor necessary to replace the stalls, mangers, floors and other stable fittings that had been taken out. It was intended to allow reasonable and proper compensation, sufficient in amount to pay for the material destroyed and to restore the premises to the condition they were in.

The amount of material torn out of stable was large because an effort was made to be entirely on the safe side and to do all possible to completely and quickly destroy infection. If the premises had been kept idle several months, so much removal of lumber, fittings, etc., would not have been required. It was, however, considered to be desirable not only to promptly eradicate contagion but also to restore the use of the premises to the owner as soon as possible.



Figure 11. To show the fumigation cape beneath which formaldehyde gas is liberated from formalin by the use of permanganate of potash. The gas is confined by the cape and surrounds the garments of the inspector.



As has been stated, eight separate outbreaks of foot-and-mouth disease in Pennsylvania were first reported to the State Veterinarian by the State Veterinarian at Harrisburg, and the infected herds, premises of these outbreaks were visited by State or Federal inspectors who, in consequence of information received by the State Veterinarian, were sent into districts where cattle had been found and who then searched for animals that had been owned by the dealers who had shipped infected or exposed cattle from East Buffalo, and for other cattle that had been in contact with these.

The veterinarians of the State can be highly commended for their skill in promptly recognizing this new and strange disease, and for their fidelity in making reports. There was but one instance of failure in these respects.

The precautions taken by veterinarians to avoid contracting infection when examining herds for foot-and-mouth disease are shown in Appendix C. In addition to the disinfection of rubber clothing as described on page 4 of this appendix, the practice was adopted upon the initiative of Dr. Bennett to fumigate the clothing under a fumigation cape. For this purpose a long rubber cape was used. The garment was long enough to reach from the neck to the floor. The opening for the head was provided with a drawing string which was tightly drawn about the neck so that after the cape was donned only the head was visible. About two ounces of formalin was placed in a little dish which stood on the floor or ground between the feet; an ounce and a half of permanganate of potash was then dropped into the dish, and the formaldehyde gas that was liberated arose and surrounded the body of the person. The period of exposure was from five to ten minutes. Fumigation was not generally practiced excepting when inspectors had been in contact with animals affected with foot-and-mouth disease, or were working in a neighborhood near an infected farm. The disinfection of rubber clothing by sponging with a solution of bichloride of mercury was, however, practiced after each inspection, whether the disease was found or not. There was no suspicion in any case that disease had been carried by any one of the State or federal inspectors.

In examining herds for foot-and-mouth disease, inspectors were instructed to handle and to look into the mouths and examine the feet of all cattle, unless the animals were so wild as to make this impracticable.

Early in the work, even before all of the known infected herds had been disposed of, and while the animals that had been associated with them were still unquarantined,

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Early in the work, even before all of the known infected herds had been disposed of, and while the animals that had been associated with affected animals were being located and quarantined, attention was also given to tracing those animals that it was thought might possibly have been exposed, from the fact that they had been through the stockyards at East Buffalo, Lancaster or elsewhere where infected animals had been. Indeed, one of the first steps taken was to locate and examine cattle that had come from East Buffalo to Pennsylvania, of which there were nearly 300 carloads, from the middle of October to the closing of the Buffalo stockyards. Upon receiving from Dr. Jones the list of shipments of cattle from East Buffalo to Pennsylvania, veterinarians in districts where these cattle had gone were communicated with by telegraph, telephone or letter, and were instructed to ascertain the present location and condition

of the animals. A large part of these cattle from East Buffalo had been slaughtered; others had been sold and widely distributed. Some had been sold more than once, by persons who kept imperfect records, and were, therefore, difficult to trace. Several weeks were required to locate or account for these cattle.

TRACING OF THE DISEASE.

After the discovery of infection in Lancaster county, and that infected cattle had come from the local stockyards, it seemed to me that it was desirable, and as promptly as possible, to trace all of the cattle that had been sold from the Lancaster stockyards during the five weeks from October 19th to November 23rd, when the stockyards were closed. To facilitate this work, I obtained lists of sales from all of the commission men at the Lancaster stockyards. The record of each lot of cattle sold was copied from these lists on to a card, which then furnished the name and address of the purchaser, the number of cattle purchased, the date of purchase and the name of the seller. These cards were classified by districts. A package of cards bearing records of all of the cattle sold from the stockyards to a certain district during the period of five weeks was then given to an inspector, whose duty it was to locate and examine the other cattle on the farms to which they had gone.

Before these inspections of shipments from Buffalo and Lancaster were finished, veterinary inspectors were assigned districts in which they were to examine all of the cattle, sheep, goats and swine on all of the farms. The magnitude of this part of the work will be realized when it is stated that there are more than 50,000 farms in the counties in which foot-and-mouth disease appeared. However, many of these farms are quite remote from localities where foot-and-mouth disease occurred, and it was not important to examine the cattle on all such farms. In order, however, that every place where infection might have gone should be investigated, it was decided to examine the cattle in localities comprising about 40,000 farms.

INSPECTION AND QUARANTINE.

Most of this particular part of the work; that is, the farm-to-farm inspection was conducted by veterinary inspectors of the Bureau of Animal Industry. All of these inspections, whether made by veterinarians in State or federal employ, were reported in duplicate, one copy of the report being sent to the office of the State Veterinarian, the other to the Bureau of Animal Industry. The report blank used for these inspections is shown in Appendix E.

While veterinarians employed by the State Livestock Sanitary Board were engaged in farm-to-farm inspection work to some extent, they were occupied chiefly: First, in making inspections where there was special reason to fear infection, as on reports on information from local veterinarians; second, in the eradication of centers of infection, including the destruction of herds and the disinfection of premises; third, in tracing shipments and in locating animals with regard to which there might be some suspicion and, fourth, in enforcing quarantine regulations with reference to shipments of scheduled animals and commodities.

Figure 18. A steam pump mounted on a portable boiler, an original device for rapid and thorough disinfection equipped especially for and purchased by the Pennsylvania State Livestock Sanitary Board. By employing a force of disinfectors as shown in this photograph a large barn and surroundings could be cleaned and disinfected in two or three days.



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The first general quarantine ever issued by the State Livestock Sanitary Board was that of November 13th. Two quarantine orders were issued by the State Livestock Sanitary Board November 24th. One of these (Appendix F.), forbade the removal of cattle, sheep, goats or swine from certain scheduled counties for any purpose or the movement of such animals into these counties excepting for immediate slaughter. The other order (Appendix G.), forbade the driving or transportation of cattle, sheep, goats or swine over public roads or highways in scheduled counties, excepting upon specific permission, in writing, from an authorized agent of the State Livestock Sanitary Board.

An order was also issued (Appendix H.), forbidding the shipment of undisinfected hides or skins from the scheduled district. It was required that disinfection should be accomplished by immersion in a solution of carbolic acid (5 per cent.), or of bichloride of mercury (1 to 1,000), or of formalin (5 per cent.) Later, this order was amended to provide that dried sheep skins might be fumigated with formaldehyde gas instead of being dipped. As has previously been stated, the removal of hay, straw, forage or of any other product that might carry infection from premises that had been occupied by infected cattle was forbidden by the quarantine that was placed on such premises. Shipment of hay, straw and similar fodder was also prohibited by general orders from scheduled counties.

The district first quarantined by the State included entire counties excepting in Lycoming county, where the infection came from Union county and was confined to a single herd in the outskirts of Williamsport, and where the conditions were such that there appeared to be no possibility that infection could have escaped from the premises.

The area quarantined by the State was diminished by the order of December 22nd, effective December 28th (Appendix I.). Under this order, the quarantine of certain parts of Dauphin, Juniata, Snyder, Union, Clinton and York counties was lifted as there appeared to be no evidence, or reason to suspect, that infection had been carried to these parts of counties. Two townships in the northeast corner of Perry county were included in the order of December 22nd, because infected cattle removed from the premises of Wm. Troutman, of Meiserville, Snyder county, to the slaughter house of his son, H. N. Troutman, in Millersburg, Dauphin county, had passed through these townships. The premises at which these animals stopped on the way from Meiserville to Millersburg were quarantined and were held in quarantine until they were disinfected. While it was alleged that there had been no contact between these three cattle of N. H. Troutman and any other cattle, still, on account of the possibility of distribution of infection along the way, the two townships were quarantined until all cattle in them could be inspected.

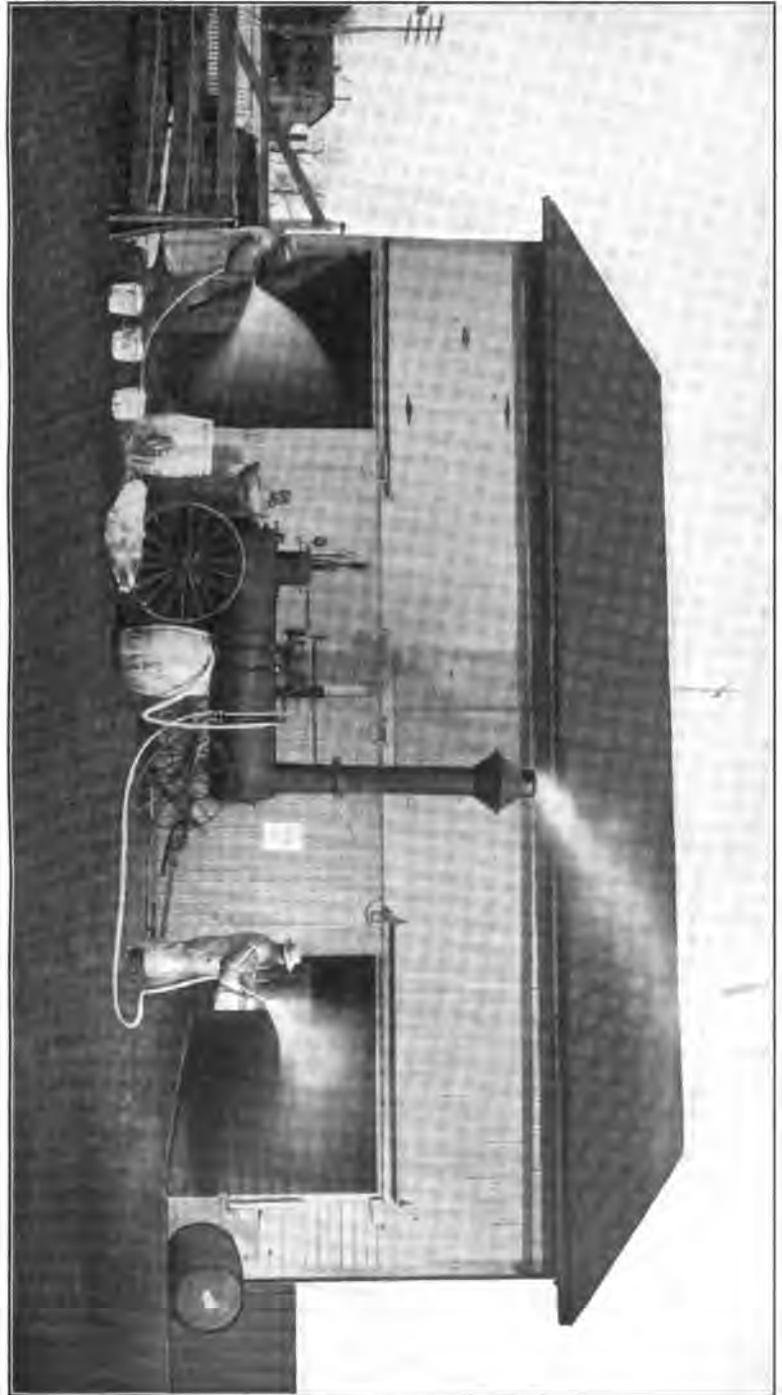
The quarantines ordered by the State Livestock Sanitary Board were very faithfully observed. Railroads regularly refused to handle shipments of livestock, hides, hay, etc., excepting in conformity with the regulations established by the State Livestock Sanitary Board and the United States Department of Agriculture. The farmers and cattle dealers generally, throughout all portions of the State

in which this work was carried on, realized the importance to them, of eradicating foot-and-mouth disease with the utmost expedition; they appreciated the necessity for the restrictions that were imposed and the regulations that were enforced and they co-operated with the authorities at almost every point. Public sentiment was such at the beginning of the outbreak, that violations of quarantine regulations would not have been tolerated in any community. Any intimation of violation in a neighborhood was followed by immediate reports to the office of the State Veterinarian. Later in the work, after all infected animals were killed and the danger appeared to be less, more difficulty was experienced in enforcing required regulations. Sheriffs, constables, police officers and officers of the law were called upon to assist in the enforcement of the quarantine regulations, and they did all that was required of them.

Quarantine restrictions forbidding the driving of cattle on public roads worked a good deal of hardship in some districts, on account of the unusual scarcity of water during the early winter. As the result of the prolonged absence of rain during the summer and fall, the water supply on many farms was exhausted. It had been customary, in such cases, for farmers to drive their cattle to the nearest spring or brook. After the quarantine order was established it became necessary to haul water in wagons. As soon, however, as inspections could be made in these regions, and it was ascertained that there were no local centers of infection, permits to drive cattle to water were issued.

Under the federal quarantine order of November 19th, the entire State of Pennsylvania was quarantined, along with the State of New York. The federal order had reference only to interstate or foreign transportation or shipment. When it became evident that there was no infection of foot-and-mouth disease in the northern and western counties of Pennsylvania, representations to this effect were made to the United States Department of Agriculture, with the request that uninfected districts in the State should be released from all quarantine restrictions. An amended quarantine order applying to Pennsylvania was issued January 2nd, 1909, effective on and after January 5th. This order scheduled twenty-five counties and a part of another county and forbade interstate shipments of cattle, sheep, other ruminants and swine from these counties, and also interstate and foreign shipments of hides, skins and hoofs and all cattle, sheep, other ruminants and swine without disinfection, and of hay, straw or similar fodder. Cattle, sheep, other ruminants and swine were permitted to be moved from other parts of Pennsylvania outside of these twenty-five counties, only for immediate slaughter, and on the condition that the authorities of the State or Territory to which the animals were destined had previously signified their willingness to accept such shipments. It was provided, further, that when such animals are shipped by rail or boat, they should not be unloaded enroute, either at points within or without the area quarantined for foot-and-mouth disease, excepting in pens designated for that purpose by the chief of the Bureau of Animal Industry, and that animals from Pennsylvania should not be unloaded into cleaned and disinfected pens especially designated by the Chief of the Bureau of Animal Industry under Rule 6, Division I for the yarding of livestock passing through the quarantined area.

Figure 14. The disinfection of a small barn with a State Livestock Sanitary Board steam disinfection pump. (The State had three steam pumps in use for purposes of disinfection.)



This amendment to the Federal quarantine line laid down by the United States Department of Agriculture, within the State of Pennsylvania, should be enforced by the State Livestock Sanitary Board in the same manner as it would be enforced by the United States Department of Agriculture if it coincided with the boundary line of the State.

To comply with the conditions under which this amendment to the Federal quarantine order was issued, a new quarantine order was adopted by the State Livestock Sanitary Board on January 5th, 1909, extending the State quarantine restrictions to include the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Centre, Union, Snyder, Mifflin, Juniata and Perry, and a portion of York county (Appendix J.) On January 11th, new regulations regarding the transportation of hides were adopted, (Appendix K).

A further modification in the Federal quarantine order was made on February 24th, 1909, effective February 25th, and on the same date the State Livestock Sanitary Board adopted a new quarantine order in accordance with the Federal modification, removing quarantine restrictions from a considerable area. (Appendix L).

On March 22nd, 1909, the Federal authorities agreed to the release from quarantine of all districts under quarantine in Pennsylvania, except several townships, boroughs and cities in the counties in which the last cases of foot-and-mouth disease had been discovered, under the same conditions as the previous modifications had been made, and an order was accordingly adopted by the State Livestock Sanitary Board, which became effective on March 26th, 1909, the same date on which the Federal amendment went into effect.

On April 19th, 1909, an order was issued by the Secretary of the United States Department of Agriculture, which became effective on April 24th, 1909, revoking the remaining quarantine restrictions, and a similar order was at once adopted by the State Livestock Sanitary Board, which became operative on the same date, thus removing all quarantine restrictions five months and two weeks after the diagnosis of the first case was officially announced by Dr. Pearson.

BRANCH OFFICES.

Arrangements were made to re-stock farms that had been infected, six weeks after the premises were disinfected. It was required that forage remaining on these farms should so far as possible be consumed on the farms. After the farms were re-stocked, they were visited by a State veterinary inspector at short intervals for several months.

As will be seen by the accompanying map and detailed outline, there was not merely one outbreak, but there were eight outbreaks of foot-and-mouth disease in rather widely spread separate parts of the State. The distance by rail from Norristown, the center of the most eastern outbreak, to Lock Haven, the most northern and western part of infection, is over two hundred miles.

It became evident from the beginning of this work that it would be necessary to have branch headquarters; accordingly, an office was opened in Danville to serve as a place from which to administer

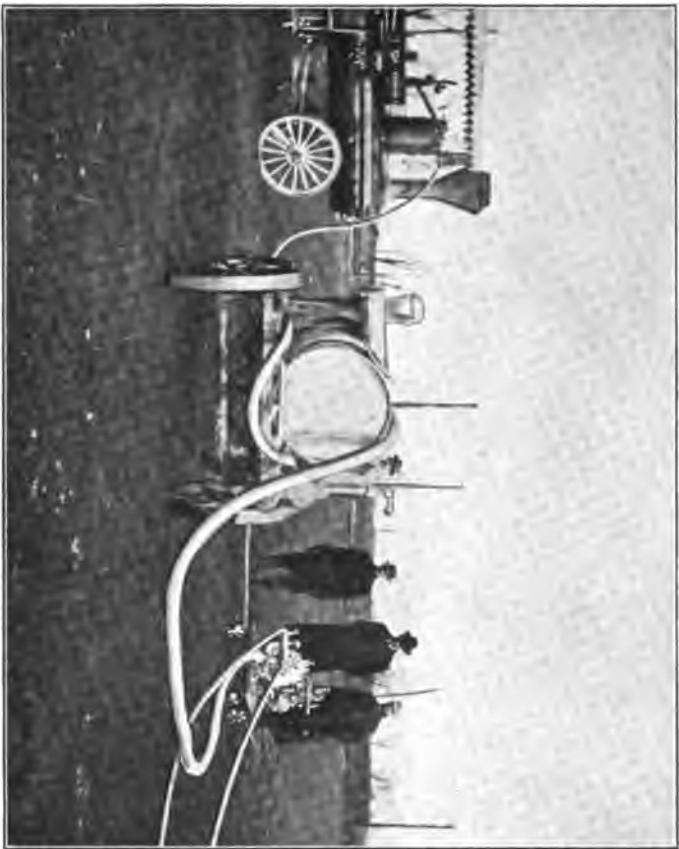
the work of that section. This office was used jointly for the work of the State Livestock Sanitary Board and the Bureau of Animal Industry; it was subsequently moved to Sunbury. Other branch offices were opened at Lancaster, Norristown, West Chester and Center Valley. The office at Center Valley was afterwards given up and the work was moved to Allentown. Each branch office was placed in charge of an agent of the State Livestock Sanitary Board. Such offices were used for the administration of the local work of the State Livestock Sanitary Board, for gathering and classifying the reports to be forwarded to Harrisburg, to attend to correspondence on subjects relating to the repression of disease, to supervise the enforcement of the quarantine and for taking care of applications for permits to move animals in the respective localities. The amount of work that was transacted through these offices was very great. As many as three hundred applications for permits to move animals have been received at a single office in one day. Until the farm-to-farm inspections had been completed in townships it was necessary to make a special inspection with relation to each of these applications, before the permit could be acted on. This necessitated the employment of a large force of veterinarians, all of whom were kept very busy. At one time, more than twenty agents of the State Livestock Sanitary Board engaged in work with relation to the enforcement of quarantines and the issuance of permits were reporting to the branch office at Lancaster.

The branch offices were continued as long as quarantine regulations were in force and the necessity for the issuance of permits continued. These offices were in charge of the following veterinarians: Dr. George B. Jobson, Sunbury; Dr. P. K. Jones, Lancaster; Dr. J. Stewart Lacock, Norristown; Dr. E. Mayhew Michener, West Chester, and Dr. A. W. Wier, Allentown.

INSPECTORS.

In the general work of the State Livestock Sanitary Board, in the management of this outbreak of foot-and-mouth disease, we were fortunate in having to start with, the services of the ten especially competent veterinarians of the Meat Hygiene Service. These veterinarians were brought at once into the work and furnished the nucleus of an immediately available staff that was engaged constantly for a time following the beginning of the outbreak. Eighty-four veterinarians were employed by the State in this work for shorter or longer periods. It would have been necessary for the State to have employed veterinary service in much larger amount if it had not been for the help that the State Livestock Sanitary

Figure 15. A steam disinfection pump mounted on a hand truck and actuated by steam from a traction engine, as planned and put in operation by Dr. Pearson. The tank carries disinfectant solution.



duties, or any arrangement as to whether a certain duty should be performed by a State or by a federal veterinary inspector. When, however, the nature of the work was such as to necessitate the co-operation of two or more inspectors, it was usually arranged that both the State and federal forces should be represented. The disinfection of premises, as has already been stated, was carried on in some instances under State, and in other instances under federal supervision. The greater part of the work incident to the enforcement of quarantined lines and of State quarantine orders developed upon the staff of the State Livestock Sanitary Board, as has the greater bulk of the work in relation to the issuance of permits for the movement of animals and of commodities within the State. The principal part of the work of conducting farm-to-farm inspections was assumed by the veterinary inspectors of the Bureau of Animal Industry. The work of disinfecting hides for shipment interstate was supervised entirely by employes of the United States Bureau of Animal Industry. These employes have also in some instances supervised the disinfection of hides that were to be shipped within the State. Most of the work, however, in supervising the disinfection of hides for intra-state shipment developed upon the agents of the State Livestock Sanitary Board.

An excessively heavy correspondence and a very great amount of office work had to be conducted in the office of the State Livestock Sanitary Board at Harrisburg. An office staff of eleven people, under the direction of Dr. Louis A. Klein, Deputy State Veterinarian, was engaged upon the necessary work incident to the control and eradication of this disease.

In addition to the clerical staff at Harrisburg, clerks or stenographers were employed at Sunbury, Lancaster, Norristown, West Chester and Allentown. The necessity for a great amount of correspondence and record keeping will be understood, when it is recalled that, at times during the outbreak, the quarantine lines established by the State included as many as fifty thousand farms, the occupants of all of which were placed under some restraint, the meaning of which had to be explained to many people. Moreover, the federal quarantine district from November 19th, 1908 to January 5th, 1909, comprised the entire State, with more than two hundred and twenty thousand farms. Traffic in cattle, sheep, other ruminants and swine, and in hides, skins and hoofs, and in hay, straw and similar forage was prohibited, or was subjected to certain restrictions. Farmers, shippers, railroad officials and railroad agents were continually applying for advice in person, by letter, telegraph and telephone. It was necessary during all of this period to keep the office of the State Veterinarian open from 7 a. m. to 12 p. m., including Sundays and holidays. After the first report of the possible existence of foot-and-mouth disease in Pennsylvania came to me, November 7th, it was necessary for me to neglect many important duties in relation to other work for a considerable period, as all of my time was devoted to the control and eradication of this disease.

I desire here to record my appreciation of the help and impetus given to this work, at every point, by the Governor and the members of the State Livestock Sanitary Board. From the beginning of the

outbreak the Governor insisted that nothing that the State can properly do to repress this disease be omitted and furnished every possible assistance to this end.

The veterinarians of Pennsylvania were exceptionally well equipped to enter a fight of this kind, on account of the system that has been followed for a long term of years for keeping the private practitioners in touch with the public veterinary work of the State.

Shortly after the beginning of the outbreak, a number of veterinarians from all parts of the State were called to Danville, Milton and Lewistown to see affected animals and to become familiar with the manifestations of the disease. These veterinarians were afterwards of great service in this work.

The veterinarians of the State, as a whole, are highly skilled and a disciplined body of men; their attitude toward veterinary work, their realization of their responsibility in relation to such work, their willingness to co-operate and their efficiency were of great service and advantage to the Commonwealth and to the nation in this emergency. A large number of veterinarians gave up all of their private work and entered the service of the State, for an amount of compensation very much less than the value of their practice. They did this because they realized the magnitude of the danger to agriculture and because they were willing to sacrifice their own interests for the benefit of the country, just as a man would volunteer for service during a war.

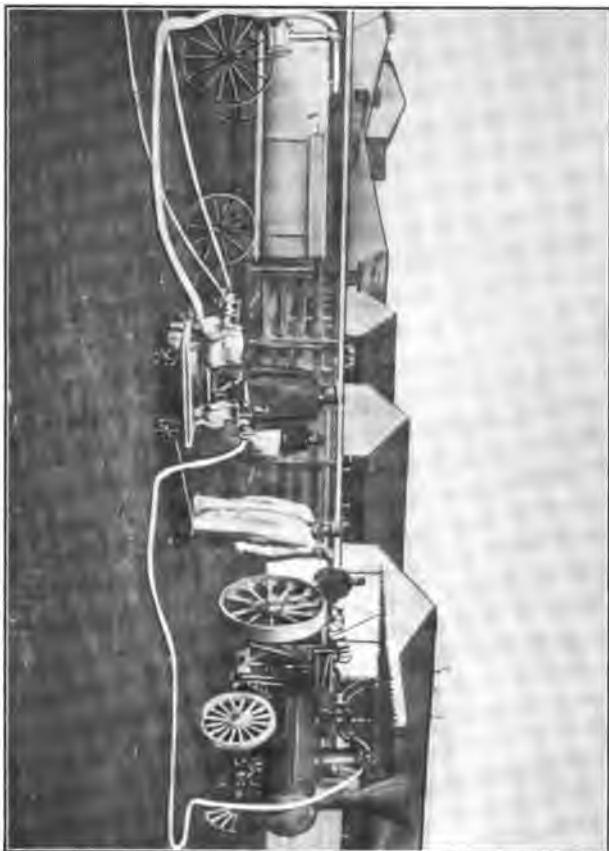
We could have enlisted the service of many more of the veterinarians of the State and undoubtedly could have conducted all of the essential work repressing foot-and-mouth disease in Pennsylvania without outside assistance, if this had been necessary. It was not necessary because we had the assistance of the highly efficient staff of the veterinary service of the United States Department of Agriculture. The work was much facilitated and expedited by the agency of members of this staff of federal veterinary inspectors, some of whom, and especially their competent leader, Dr. Bennett, had experience afforded by the work of exterminating foot-and-mouth disease from New England six years ago. When, however, foot-and-mouth disease was found to exist in New York, Maryland and Michigan most of the federal veterinary inspectors who had been employed in the New England outbreak were withdrawn from Pennsylvania for services in other states.

The advantages from co-operation with the United States Department of Agriculture consisted in obtaining upon short notice the services of a large corps of disciplined inspectors, some of whom had previous experience with this disease, and of sharing the cost of the work with the federal government, thus effecting a saving to the treasury of the State.

SUMMARY.

The following is a condensed statement with relation to the eight outbreaks of foot-and-mouth disease that have occurred in Pennsylvania. This statement shows the source of infection, in each case, to have been cattle shipped from East Buffalo, N. Y. Facts in relation to these several shipments of infected and exposed cattle are set forth, and lists are furnished of all herds that became infected, directly or indirectly, from such shipments. This summary also shows

Figure 16. The same equipment shown in figure 15, as used at the stockyards at Lancaster. (The State Livestock Sanitary Board had a pump of this kind that was used in Lancaster but the one here shown was the property of the Stock Yards Company.)



the location of the various infected herds, the number of diseased and exposed animals, the dates when the separate lots of infected animals were killed, and the appraisements. Memoranda are added to show by whom report was first made, diagnosis established and quarantine laid, as recorded in the office of the State Livestock Sanitary Board.

DANVILLE OUTBREAK.

Source: J. C. Campbell shipped a carload of cattle from East Buffalo, N. Y., October 26th, 1908, to Danville, Montour county, Pa. These cattle were received October 27th, 1908. The origin of these cattle was as follows: Blaine, Mich., 1 head; Mt. Pleasant, Mich., 1 head; Melvin, Mich., 1 head; Clare, Mich., 2 heads; North Manchester, Ind., 1 head; Ransom, Ohio, 1 head, Bad Axe, Mich., 1 head; Marion, Ohio, 11 heads. The shipments comprised 10 steers and 9 bulls. The steers were slaughtered at Danville. Eight bulls were sold and one was taken by Mr. Campbell to his own farm in Rush township, Northumberland county.

This outbreak became known through a report from Dr. J. O. Reed, of foot-and-mouth disease in the herd of Jacob Schultz, (1). Infestation was then traced back to cattle sold by Mr. Campbell. All cattle exposed to the Campbell cattle were sought and quarantined. The following herds became infected by or from cattle of this shipment:

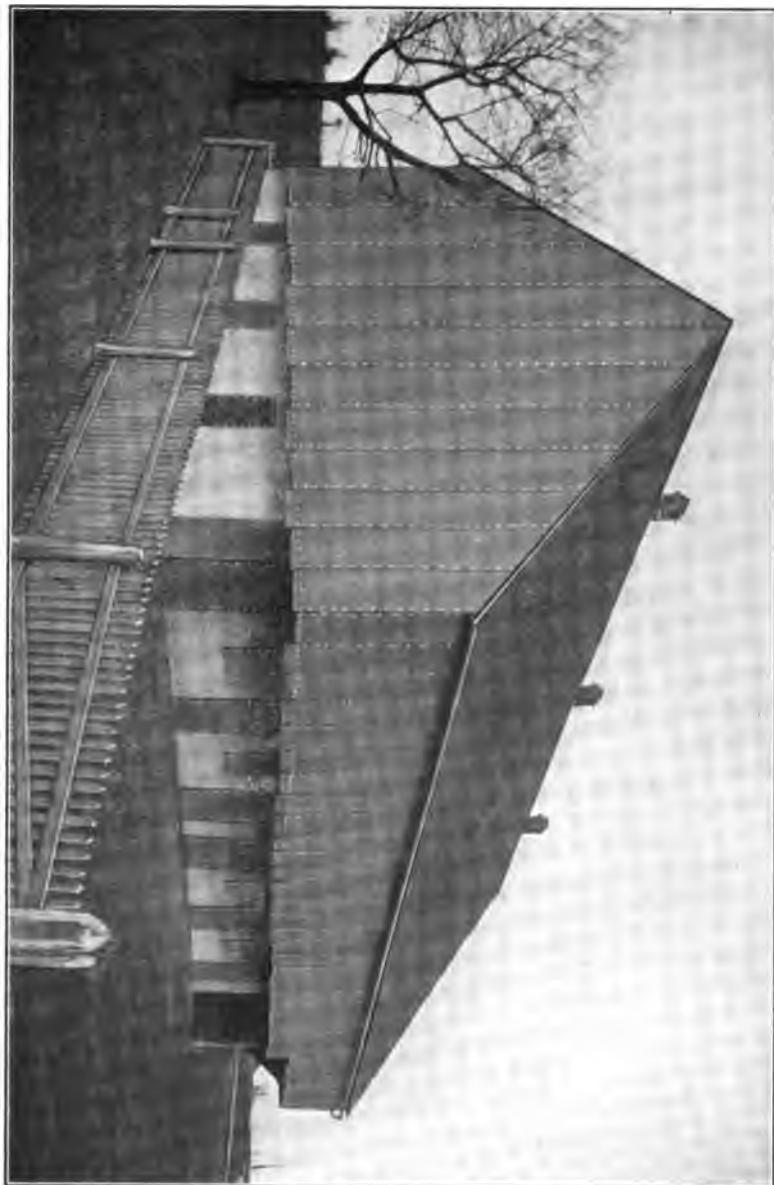
1. Jacob Schultz, Cooper township, Montour county.
Mr. Schultz bought one bull from J. C. Campbell, October 29th, 1908. Reported by J. O. Reed. Inspected and quarantined by T. E. Munce November 7th, 1908. Diagnosis confirmed by Leonard Pearson, November 8th, 1908.
Animals destroyed: 40 cattle, 18 swine.
Appraisement of animals, \$2,018.50.
2. James Schultz, Borough of Danville, Montour county.
Inspected and quarantined by Dr. D. E. Hickman, November 14th, 1908. James Schultz visited and examined the diseased cattle of his son, Jacob Schultz, three miles away, and afterwards cared for his own family cow, which subsequently developed foot-and-mouth disease.
Animals destroyed: 1 cow, 4 swine.
Appraisement of animals, \$77.
3. E. E. Bogert, Rush township, Northumberland county.
Inspected by J. O. Reed, and H. R. Church. Quarantined November 8th, 1908, by J. O. Reed.
Mr. Bogert bought a bull from J. C. Campbell, October 29th, 1908.
Animals destroyed: 24 cattle, 18 swine.
Appraisement of animals, \$796.50.
4. Edward Sees, Rush township, Northumberland county.
Mr. Sees had one cow on the premises of E. E. Bogert.
This cow was inspected and quarantined with the cattle of E. E. Bogert.
Animals destroyed: 1 cow.
Appraisement of animal, \$60.

5. H. E. Fisher, Rush township, Northumberland county.
Inspected by J. O. Reed and G. M. Graybill.
Quarantined by J. O. Reed, November 8th, 1908.
Mr. Fisher bought 1 bull from J. C. Campbell, October 29th, 1908.
Animals destroyed: 13 cattle, 21 swine.
Appraisement of animals, \$578.
6. P. W. Mettler, Rush township, Northumberland county.
Inspected by J. O. Reed and G. M. Graybill.
Quarantined by J. O. Reed, November 10th, 1908.
Mr. Mettler bought 2 cows from J. C. Campbell, October 29th, 1908.
Animals destroyed: 5 cattle, 11 swine.
Appraisement of animals, \$305.50.
7. Norman C. Reed, Rush township, Northumberland county.
Inspected by J. O. Reed and D. E. Hickman.
Quarantined by J. O. Reed, November 9th, 1908.
Mr. Reed bought 1 bull from J. C. Campbell, October 29th, 1908.
Animals destroyed: 8 cattle, 21 swine.
Appraisement of animals, \$271.30.
8. E. H. Schultz, Rush township, Northumberland county.
Inspected by J. O. Reed, T. E. Munce, C. C. McLean and George B. Jobson.
Quarantined by J. O. Reed November 7th, 1908.
Mr. Schultz bought 1 bull from J. C. Campbell, October 29th, 1908.
Animals destroyed: 13 cattle, 25 swine.
Appraisement of animals, \$563.50.
9. J. C. Campbell, Rush township, Northumberland county.
Inspected by J. O. Reed and J. H. Turner.
Quarantined by J. O. Reed November 8th, 1908.
Mr. Campbell took to his farm October 28th, 1908, 1 bull of his shipment from Buffalo.
Animals destroyed: 10 cattle, 44 swine.
Appraisement of animals, \$730.70.
10. Charles A. Gulick had a brood sow which strayed onto the farm of Mr. Campbell. It was quarantined there and was destroyed with Mr. Campbell's cattle.
Animals destroyed, 1 sow.
Appraisement of animal, \$18.00.
Total number of animals destroyed in the Danville outbreak: cattle, 115, swine, 163.
Total appraisement for animals, \$5,419.

WATSONTOWN OUTBREAK.

Source: James M. Montgomery shipped a carload of young cattle from East Buffalo, N. Y., October 26th, 1908, to Watsontown, Northumberland county. These cattle were received October 27th, 1908; their origin was as follows: Toronto, Canada, 32 head; Clare, Mich., 5 head; Honeeye Falls, N. Y., 2 head. The shipment comprised 39 head. Some of these were slaughtered, others were sold in the neighborhood, but most of them were taken to Mr. Montgomery's farm near Turbotville. This outbreak became known through a re-

Figure 17. A drawing modified from a photograph to show how the sides of a loosely constructed building may be covered with paper and how the doors and windows may be covered to prepare for disinfection by fumigation. In this case, the attempt at fumigation was a failure because the gas rapidly escaped through the shingled roof. The serviceable disinfection in this instance was accomplished with a State steam pump.



port from Dr. T. H. McNeal, of foot-and-mouth disease in the herd of Eli Yost (15). Infection was traced to the premises of J. M. Montgomery. All cattle sold by Mr. Montgomery or exposed to his cattle were sought out and quarantined. The list of cattle sold was obtained by Leonard Pearson November 9th, and 10th, 1908, and the cattle were traced immediately. The following herds became infected directly or indirectly from the cattle of this shipment.

Two hours after Mr. Montgomery's cattle had been unloaded over the platform of the railroad station at Watsontown, some cows shipped to E. E. Shively were unloaded. These cows did not come in contact with the Montgomery cattle, but only with the platform and the surface over which Mr. Montgomery's cattle had passed a short time before.

11. George Kerstetter, Delaware township, Northumberland county.
Inspected by A. O. Cawley, George B. Jobson, O. G. Noack and H. T. McNeal.
Quarantined by A. O. Cawley November 11th, 1908.
Mr. Kerstetter bought 1 steer from J. M. Montgomery, November 6th, 1908.
Animals destroyed: 1 steer.
Appraisement of animal, \$32.
12. S. M. Blaine, Turbotville, Lewis township, Northumberland county.
Inspected by A. O. Cawley, H. T. McNeal and H. R. Church.
Quarantined by A. O. Cawley November 11th, 1908.
Mr. Blaine bought 1 bull from J. M. Montgomery, November 7th, 1908.
Animals destroyed: 1 bull.
Appraisement of animal, \$18.20.
13. Jerry Renn, Lewis township, Northumberland county.
Inspected by Leonard Pearson, H. T. McNeal, A. O. Cawley, H. R. Church, George B. Jobson and O. G. Noack.
Quarantined by Leonard Pearson November 9th, 1908.
Mr. Renn bought 2 heifers from J. M. Montgomery November 6th, 1908.
Animals destroyed: 13 cattle, 29 swine.
Appraisement of animals, \$684.
14. W. T. Nye, Delaware township, Northumberland county.
Inspected by A. O. Cawley, O. G. Noack, H. T. McNeal and H. R. Church.
Quarantined by A. O. Cawley November 11th, 1908.
Mr. Nye bought 2 steers from J. M. Montgomery November 6th, 1908.
Animals destroyed: 11 cattle, 5 swine.
Appraisement of animals, \$474.65.
15. Eli Yost, Delaware township, Northumberland county.
Inspected by H. T. McNeal, Leonard Pearson, O. G. Noack and A. O. Cawley.
Quarantined by Leonard Pearson November 9th, 1908.
Mr. Yost removed November 2nd, 1908, to his farm, a cow that had been pasturing on Mr. Montgomery's farm and that had

been in contact with the cattle shipped from East Buffalo, N. Y.

Animals destroyed: 16 cattle, 40 swine.

Appraisement of animals, \$850.

16. Charles A. Noll, Kelly township Union county.

Inspected by O. G. Noack, George B. Jobson, H. R. Church and P. K. Jones.

Quarantined by O. G. Noack November 11th, 1908.

Two cows were placed on Mr. Noll's farm November 3rd, 1908, by Lewis Magee. These cows were purchased from Eli Yost and had been pastured on the farm of J. M. Montgomery and had been in contact with the cattle shipped from East Buffalo, N. Y. These two cows were part of a lot of 19 head that Mr. Magee had purchased and was storing on Mr. Noll's farm until he should have a carload ready for shipment to Chester county. Mr. Magee's cattle and Mr. Noll's cattle were in contact and all became infected.

Animals destroyed: property of C. A. Noll, 17 cattle, 21 swine.

Appraisement of animals, \$700.

Animals destroyed: property of Lewis Magee, 19 cattle.

Appraisement of animals, \$638.50.

17. Lewis Magee, Lewisburg, Union county.

Inspected by George B. Jobson, E. P. Althouse, O. G. Noack and A. O. Cawley.

Quarantined by George B. Jobson and A. O. Cawley, November 14th, 1908.

Mr. Magee bought 1 cow from E. E. Shively, November 4th, 1908. He had 6 cows and 2 calves in the stable on his premises in Lewisburg that he had purchased at different times and that were intended for sale.

Animals destroyed: 8 cattle.

Appraisement of animals, \$330.

18. Harry Bressler, Lewis township, Northumberland county.

Inspected by H. R. Church.

Quarantined by H. R. Church, December 1st, 1908.

This herd is supposed to have become infected through contagion carried on the clothing of Mr. Bressler, father of Harry Bressler, who was employed by Eli Yost and who worked among Mr. Yost's diseased cattle.

Animals destroyed: 8 cattle, 15 swine.

Appraisement of animals, \$331.

19. C. A. Herman, Buffalo township, Union county.

Inspected by Geo. B. Jobson, P. K. Jones, O. G. Noack and A. O. Cawley.

Quarantined by George B. Jobson November 12th, 1908.

Mr. Herman bought a cow from Lewis Magee November 7th, 1908. This cow had been on the farm of C. A. Noll.

Animals destroyed: 11 cattle, 18 swine.

Appraisement of animals, \$649.50.

20. J. M. Montgomery (Mrs. E. S. Montgomery), Lewis township, Northumberland county.

Inspected by Leonard Pearson, H. T. McNeal, O. G. Noack, George B. Jobson, H. R. Church and A. O. Cawley.

Quarantined by Leonard Pearson November 9th, 1908.

Mr. Montgomery brought most of the cattle of his shipment from East Buffalo, N. Y., to his farm October 27th, 1908, where they came in contact with 5 heifers belonging to himself, 2 cows belonging to R. Bergerstock and 3 cows belonging to Eli Yost. One of the Yost cows was removed to Mr. Yost's farm November 2nd, 1908; the other 2 were sold to Lewis Magee, who took them to the farm of C. A. Noll.

Animals destroyed: 28 cattle, 40 swine.

Appraisement of animals, \$753.50.

21. Bertram Bergerstock, Lewis township, Northumberland county. Mr. Bergerstock had two cows on Mr. Montgomery's farm. Both became infected by contact with the cattle from East Buffalo.

Animals destroyed: 2 cows.

Appraisement of animals, \$105.00.

22. B. F. Schreck. White Deer township, Northumberland county. Inspected by H. R. Church, H. T. McNeal and George B. Jobson. Quarantined by H. R. Church November 25th, 1908.

Mr. Schreck bought 3 cows and 1 bull from E. E. Shively November 4th, 1908.

Animals destroyed: 16 sheep, 22 cattle, 39 swine.

Appraisement of animals, \$1,478.

23. C. H. Winters, Williamsport, Lycoming county.

Inspected by H. R. Church and H. T. McNeal.

Quarantined by H. T. McNeal December 3rd, 1908.

Mr. Winters bought 2 cows from E. E. Shively, November 4th, 1908.

Animals destroyed: 24 cattle, 12 swine.

Appraisement of animals, \$1,600.

24. W. C. Foresman, Gregg township, Union county.

Inspected by H. R. Church and H. T. McNeal.

Quarantined by H. R. Church December 8th, 1908.

Mr. Foresman bought 3 cows from E. E. Shively November 4th, 1908.

Animals destroyed: 39 cattle, 56 swine.

Appraisement of animals, \$1,351.80.

Total number of animals destroyed in the Watsontown outbreak:

cattle, 220; swine, 275; sheep, 16.

Total appraisement of animals, \$9,996.15.

LOCK HAVEN OUTBREAK.

Source: Two butchers on the outskirts of Lock Haven, F. L. Winner and B. Zuber, have for a long time been engaged in shipping cattle for slaughter from East Buffalo, N. Y. Just what shipment brought the infection of foot-and-mouth disease from East Buffalo to Lock Haven has not been determined, as all of the cattle from that place had been slaughtered before knowledge of foot-and-mouth disease came to Dr. C. R. Good, and was by him transmitted to the office of the State Veterinarian. The first discovered appearance of this disease in the locality was among the cattle of Roy M. Hanna, whose pasture is near the Winner slaughter house, and also near that of Zuber.

The outbreak became known through a report received November 19th, 1908, by the State Veterinarian from Dr. C. R. Good, of foot-and-mouth disease among Mr. Hanna's cattle. No infection of foot-and-mouth disease was at any time found on Mr. Zuber's premises. There was very extensive infection among hogs on Mr. Winner's premises.

The origin of these cattle was as follows: Eaton, Ind., 2 head; Alexander, N. Y., 1 head; Bryan, Ohio, 1 head; Hudson, Mich., 1 head; Thomas, Mich., 16 head; Adrian, Mich., 6 head; Manchester, Mich., 4 head; Harbor Beach, Mich., 3 head; Camden, Mich., 1 head; Pigeon, Mich., 6 head; Hilsdale, Mich., 4 head.

The infected cattle were presumably among cattle shipped from East Buffalo in one of the following loads:

November 2nd, 1908,	36 head.
November 9th, 1908,	24 head.

25. F. L. Winner, Lock Haven, Clinton county.

Mr. Winner received and slaughtered between October 19th and November 9th, 1908, inclusive, 103 cattle from East Buffalo. Hogs infected with foot-and-mouth disease were in the yard of the slaughter house where these cattle were slaughtered.

Inspected and quarantined by Edward Seidel November 23rd, 1908.

Animals destroyed: 80 swine.

Appraisement of animals, \$580.

26. Roy M. Hanna, Castanea township, Clinton county.

Mr. Hanna pastured cattle in a field near the slaughter house premises on which there were many hogs affected with foot-and-mouth disease.

Inspected and quarantined by Edward Seidel November 21st, 1908.

Animals destroyed: 18 cattle, 57 swine.

Appraisement of animals, \$1,021.87.

27. H. G. Maurer, Porter township, Clinton county.

Mr. Maurer delivered sheep to Mr. Winner's slaughter house November 14th, 1908, while Mr. Winner's premises were infected with foot-and-mouth disease. When delivering the sheep, he walked through the infected premises. Presumably he carried infection on his boots or clothing to his own farm.

Inspected and quarantined by Edward Seidel November 22nd, 1908.

Animals destroyed: 6 cattle, 25 swine, 24 sheep.

Appraisement of animals, \$515.50.

28. H. H. Martin, Lamar township, Clinton county.

Mr. Martin's father, C. W. Seaholtz, purchased from Roy M. Hanna, 1 sow and 7 young pigs about November 15th, 1908.

Inspected and quarantined by Edward Seidel November 2nd, 1908.

Animals destroyed: 20 cattle, 30 swine.

Appraisement of animals, \$775.

29. Hayes Dorey, Island, Dunstable township, Clinton county.

Mr. Dorey had but one cow; it was taken to Mr. Hanna's farm for service by Mr. Hanna's bull, November 15th, 1908.

Inspected and quarantined by Edward Seidel November 23rd, 1908.

Animals destroyed: 1 cow, 4 swine.

Appraisement of animals, \$75.

Total number of animals destroyed in the Lock Haven outbreak: cattle, 45; swine, 196; sheep, 24.

Total appraisement of animals, \$2,967.37.

VERA CRUZ OUTBREAK.

Source: A. J. Bean shipped a carload of cattle from East Buffalo, N. Y., November 2nd, 1908, to Vera Cruz, Lehigh county. These cattle were received November 3rd, 1908. The origin of the cattle was as follows: Applegate, Mich., 1 head; Sinclairville, N. Y., 6 head; Sinclairville, N. Y., 1 head; Russel, Pa., 7 head; Claypool, Ind., 2 head; Belvidere, N. Y., 7 head; Stanton, Mich., 1 head.

These cattle were driven to Limeport, Lehigh county and were placed in the yard of the hotel kept by A. F. Frantz; they were sold November 6th, 1908. There is no history to prove that any of the cattle were diseased at that time. This outbreak became known through a report received at the office of the State Veterinarian, Harrisburg, Pa., November 16th, 1908, from Dr. O. J. Biehm, of Center Valley, Lehigh county. Dr. Biehm found seven affected animals in a herd of twenty belonging to John H. Stauffer. The infection of this herd was traced to cattle sold by A. J. Bean. All cattle of the infected shipment and cattle that were exposed to them were inspected and quarantined. There was no extension of this outbreak beyond the herds infected directly by the animals received from East Buffalo. The following herds became infected directly by cattle from this shipment:

30. John H. Stauffer, Upper Saucon township, Lehigh county.
Mr. Stauffer bought 2 steers from A. J. Bean, November 6th, 1908.
Inspected by C. C. McLean, G. M. Graybill, G. G. Blank and O. J. Biehm.
Quarantined by G. M. Graybill November 16th, 1908.
Animals destroyed: 20 cattle, 18 swine.
Appraisement of animals, \$982.50.
31. M. O. Schantzenbach, Upper Milford township, Lehigh county.
Mr. Schantzenbach bought 2 bulls from A. J. Bean, November 6th, 1908.
Inspected by C. C. McLean and G. M. Graybill, November 18th, 1908.
Quarantined by G. M. Graybill November 18th, 1908.
Animals destroyed: 4 cattle, 7 swine.
Appraisement of animals, \$264.22.
32. Lewis Morgan, Upper Milford township, Lehigh county.
Mr. Morgan bought 4 bulls from A. J. Bean November 6th, 1908.
Inspected by C. C. McLean and G. M. Graybill.
Quarantined by C. C. McLean November 18th, 1908.
Animals destroyed: 15 cattle, 11 swine.
Appraisement of animals, \$705.00.

33. H. C. Bahl, Upper Saucon township, Lehigh county.
 Mr. Bahl bought 1 bull from A. J. Bean, November 6th, 1908.
 Inspected by G. M. Graybill and C. C. McLean, November 18, 1908.
 Quarantined by C. C. McLean November 18, 1908.
 Animals destroyed: 3 cattle 16 swine.
 Appraisement of animals, \$177.53.
34. A. F. Frantz, Lower Milford township, Lehigh county.
 Mr. Frantz bought 1 bull from A. J. Bean, November 6th, 1908.
 Inspected by C. C. McLean and G. M. Graybill.
 Quarantined by C. C. McLean, November 18th, 1908.
 Animals destroyed: 1 bull.
 Appraisement of animal, \$21.18.
35. Samuel E. Hartman, Upper Saucon township, Lehigh county.
 Mr. Hartman bought 1 cow from A. J. Bean, November 6th, 1908.
 Inspected by G. M. Graybill and C. C. McLean.
 Quarantined by G. M. Graybill, November 19th, 1908.
 Animals destroyed: 8 cattle, 11 swine.
 Appraisement of animals, \$316.25.
36. Bernard Selig, Upper Saucon township, Lehigh county.
 Mr. Selig purchased 9 bulls from A. J. Bean, November 6th, 1908.
 Inspected by G. M. Graybill and C. C. McLean.
 Quarantined by C. C. McLean, November 19th, 1908.
 Animals destroyed: 14 cattle, 10 swine.
 Appraisement of animals, \$371.
37. Charles Schaffer, Lower Milford township, Lehigh county.
 Mr. Schaffer bought 1 cow from A. J. Bean, November 6th, 1908.
 Inspected by G. M. Graybill and C. C. McLean.
 Quarantined by G. M. Graybill, November 19th, 1908.
 Animals destroyed: 5 cattle, 5 hogs.
 Appraisement of animals, \$229.
38. John Jacoby, Upper Saucon township, Lehigh county.
 Mr. Jacoby purchased 2 bulls from A. J. Bean, November 6th, 1908.
 Inspected by N. A. Fulmer, O. J. Biehn and C. C. McLean.
 Quarantined by N. A. Fulmer, December 1st, 1908.
 Animals destroyed: 23 cattle, 18 swine.
 Appraisement of animals, \$848.00.
 Total number of animals destroyed in the Vera Cruz outbreak:
 cattle, 93; swine, 91.
 Total appraisements of animals, \$3,914.68.

GERMANSVILLE OUTBREAK.

Source: George A. Bachman shipped two carloads of cattle comprising 64 head from East Buffalo, October 26th, 1908, to Germansville, Lehigh county. These cattle were received October 28th, 1908. The cattle of the shipment were divided into two lots, one of which was sent to Neffs, Lehigh county, where they were sold October 30th, 1908, and the other lot was sold at Germansville, October 29th, 1908. The cattle shipped by Mr. Bachman were from a lot of 80 cows that originated as follows: Reed City, Mich., 2 head; Flushing, Mich., 2 head; Melvin, Mich., 22 head; Sinclairville, N. Y., 1 head; Brown City, Mich., 1 head; Harrisville, Mich., 2 head; Bellvere, Mich., 1

head; Cincinnati, Ohio, 2 head; Avoca, Mich., 16 head; Fillmore, N. Y., 4 head; McGregor, Mich., 5 head; Hershey, Mich., 5 head; Deckerville, Mich., 15 head; Stroh, Ind., 1 head; Bryan, Ohio, 1 head.

Report of this outbreak was received from Dr. C. D. Werley, November 18th, 1908. The report showed that a bull purchased from Mr. Bachman by Frank Metzger developed foot-and-mouth disease and afterwards Mr. Metzger's cows became infected. This bull is the only animal of the lot sold at Germansville that is known to have carried infection. Other animals of this lot were traced and were held in quarantine for a number of weeks and were released when it was found that neither they nor the cattle with which they were associated presented any evidence of foot-and mouth disease. Of the cattle sold at Neffs, two carried infection.

The fact that so few cattle of this lot of the 64 carried the infection of foot-and-mouth disease is no doubt to be explained by the presumption that all of these animals were free from infection when they were received at the stock-yards at East Buffalo. It appears that only a part of the animals were exposed in the East Buffalo stockyards and these did not develop disease until after they had been sold by Mr. Bachman; consequently the other cattle of the Bachman shipments were not directly exposed and did not become infected. The cattle were in Mr. Bachman's possession a very short time as will be seen by the dates of his transactions; they were purchased in Buffalo, October 26th, 1908 and were sold three or four days later. If Mr. Bachman had kept these cattle a few days longer before they were sold, undoubtedly they would have carried the infection into most of the herds they entered.

39. Frank Metzger, Lynn township, Lehigh county.

Mr. Metzger purchased 3 cattle for slaughter from G. A. Bachman, October 29th, 1908. He took the cattle home and turned them into the pasture with his native cattle. The disease was first observed in the bull purchased from Bachman.

Inspected by C. D. Werley and A. O. Cawley.

Quarantined by A. O. Cawley, November 19th, 1908.

Animals destroyed: 5 cattle, 6 swine.

Appraisement of animals, \$256.

40. John Schneck, North Whitehall township, Lehigh county.

Mr. Schneck purchased 1 heifer from George A. Bachman at Neffs, October 30th, 1908.

Inspected and quarantined by A. O. Cawley, November 21st, 1908.

Animals destroyed: 4 cattle, 5 swine.

41. David Fenstermacker, Lowhill township, Lehigh county.

Mr. Fenstermacker purchased 1 bull from G. A. Bachman at Neffs, October 30th, 1908.

Inspected and quarantined by A. O. Cawley, November 24th, 1908.

Animals destroyed: 6 cattle, 4 swine.

Appraisement of animals, \$203.

42. Herbert M. Wotring, Lowhill township, Lehigh county.
The infection in this case was probably carried by Mr. Wotring's boy who was said to have visited the premises of David Fenstermacker (41).
Inspected and quarantined by G. E. Totten, S. L. Bond and G. D. Warner, November 27th, 1908.
Animals destroyed: 12 cattle, 6 swine.
Appraisement of animals, \$488.
Total number of animals destroyed in the Germansville outbreak: cattle, 27; swine, 21.
Total appraisements of animals, \$1,167.

MIDDLEBURG OUTBREAK.

Source: William Troutman shipped from East Buffalo, N. Y., Monday, November 2nd, 1908, a carload of cattle comprising 30 young feeder steers and 3 butcher steers. These cattle were received at Middleburg, November 30th, 1908, and were unloaded at the unloading chute near the railroad station. The cattle were kept over night in the field of W. Kuster, near his mill, upon the edge of Middleburg. From this field 15 steers were sold to E. Bower. The next morning, Wednesday, November 4th, 1908, the remaining cattle were taken to Fremont. One steer was sold at Fremont to Thomas F. Reichenbach and one steer to Isaac Mengle. The cattle were kept Wednesday night at E. Garman's, near Fremont. The 3 butcher steers were taken from the drove at Fremont and were driven to Wm. Troutman's farm at Mieserville, whence they were moved Friday, November 6th, 1908, to H. N. Troutman's slaughter house, Millersburg, Dauphin county. From Fremont the cattle were driven to Evendale, Juniata county, where 4 were sold November 5th, 1908, to M. D. Shirk and 9 to Jacob Schallenberger.

A second lot of cattle was purchased in Buffalo Monday, November 9th, 1908. This lot comprised 18 steers and 8 heifers.

These cattle were received at Middleburg Tuesday, November 10th, and were unloaded over the same chute as that used for the shipment of the preceding week, and spent Tuesday night in the same pasture field of W. Kuster that was occupied the week before by the earlier shipment. At Middleburg 3 steers and 1 heifer was sold to A. H. Dinius, of Kramer. The cattle were taken from Middleburg from Mr. Troutman's farm at Meiserville, Wednesday, November 11th. George Rine bought 8 steers which were at once removed to his own farm; A. Bichart of Meiserville, bought 1 heifer; J. M. Bason of Richfield, Juniata county, bought 5 heifers and H. N. Troutman of Millersburg, Dauphin county, 3 butcher cattle, which were removed to his slaughter house Tuesday, November 7th, 1908. Wm. Troutman retained of this shipment 1 heifer and 4 steers.

The first symptoms among Mr. Troutman's cattle were seen Sun-

Knowledge of this outbreak was received by telephone at the office of the State Veterinarian from Dr. A. R. Potteiger, of Selins Grove, who had been called in to see these cattle Tuesday, November 17th, 1908. Mr. Troutman's herd was inspected and quarantined November 18th, 1908, by Leonard Pearson. At that time, 4 steers of the shipment from Buffalo were exhibiting distinct evidence of foot-and-mouth disease in the earlier stages; in two of them the vesicles had broken. The heifer of the Buffalo shipment of November 9th, showed no distinct evidence of foot-and-mouth disease but it was found to have a temperature of 105.4° F. The following day there were well marked vesicles in the mouth of this heifer. From the history of development of foot-and-mouth disease of these cattle it would seem to be probable that they were infected as a result of exposure sustained at about the time or shortly after their arrival at Middleburg.

On the occasion of the first visit to Mr. Troutman's farm a complete list was obtained of all the cattle that had been sold from the two shipments. These animals and the premises that they had gone to were immediately inspected. The following herds became infected by or from the cattle of this shipment:

43. E. Bower, Franklin township, Snyder county.
Inspected and quarantined by E. S. Deubler, November 18th, 1908.
Animals destroyed: 19 cattle.
Appraisement of animals, \$515.00.
44. John F. Newman, Franklin township, Snyder county.
Inspected and quarantined by E. S. Deubler, November 18, 1908. Mr. Newman was the tenant on the farm owned by Bower Brothers, and cattle purchased by E. Bower came in contact in field with cattle purchased from Wm. Troutman.
Animals destroyed: 13 cattle, 12 swine.
Appraisement of animals, \$485.00.
45. A. B. Kline, Franklin township, Snyder county.
Inspected and quarantined by S. C. Babson.
Mr. Kline's cow is believed to have become affected from the Newman or the Bower cattle by the agency of Mr. Kline, who walked through the pasture field occupied by these cattle in going to and from his work on his father's farm.
Animals destroyed: 1 cow.
Appraisement of animal, \$35.00.
46. Mrs. Ida Walter, Franklin township, Snyder county.
Inspected by S. C. Babson and E. P. Althouse. Quarantined by S. C. Babson, November 30th, 1908. This cow was ex-

- Mr. Mengle bought 1 steer of Wm. Troutman, Wednesday, November 4, 1908.
Animals destroyed: 12 cattle, 17 swine.
Appraisement of animals, \$344.00.
49. Jacob Shallenberger, Monroe township, Juniata county.
Inspected and quarantined by Geo. B. Jobson and E. P. Alt-house, November 18th, 1908.
Mr. Shallenberger bought 9 steers November 5th, 1908, from William Troutman.
Animals destroyed: 12 cattle.
Appraisement of animals, \$240.00.
50. J. F. Heckman, Monroe township, Juniata county.
Inspected and quarantined by Geo. B. Jobson and E. P. Alt-house, November 19th, 1908.
Mr. Heckman had but one cow and it was a member of the herd of Jacob Shallenberger.
Animal destroyed: 1 cow.
Appraisement of animal, \$40.00.
51. M. B. Shirk, Monroe township, Juniata county.
Inspected and quarantined by Geo. B. Jobson and E. P. Alt-house, November 19th, 1908.
Mr. Shirk bought 4 steers of Wm. Troutman, November 5th, 1908.
Animals destroyed: 7 cattle, 6 swine.
Appraisement of animals, \$226.75.
52. J. H. Lauver, Monroe township, Juniata county.
Inspected and quarantined by Geo. B. Jobson and E. P. Alt-house, November 19th, 1908.
Mr. Lauver bought a steer from Mr. Shirk. When this steer was examined, November 19th, it was found to have an old lesion and some of Mr. Lauver's cattle showed symptoms of recent infection.
Animals destroyed: 11 cattle, 9 swine.
Appraisement of animals, \$343.
53. A. H. Dinius, Middle Creek township, Snyder county.
Inspected by E. S. Deubler, Oscar Carey and H. T. McNeal.
Quarantined by E. S. Deubler, November 19th, 1908, and by H. T. McNeal, December 18th, 1908.
Mr. Dinius purchased 3 steers and 1 heifer from Mr. Troutman on November 11th, 1908.
Animals destroyed: 13 cattle, 10 swine.
Appraisement of animals, \$672.
54. George Rine, Chapman township, Snyder county.
Inspected by A. R. Potteiger, Leonard Pearson and O. G. Noack.
Quarantined by Leonard Pearson November 18th, 1908.
Mr. Rine bought 8 steers November 11th, 1908, from Wm. Troutman.
Animals destroyed: 23 cattle, 12 sheep, 11 swine.
Appraisement of animals, \$921.27.
55. Arthur Bichart, Chapman township, Snyder county.
Inspector by O. G. Noack and A. R. Potteiger, November 20th, 1908.
Quarantined by O. G. Noack, November 20th, 1908.

- Mr. Bichart bought 1 heifer from Wm. Troutman November 10th, 1908.
Animals destroyed: 1 heifer.
Appraisement of animal, \$18.
56. J. M. Basom, Mcnroe township, Juniata county.
Inspected by George B. Jobson and E. P. Althouse.
Quarantined by George B. Jobson, November 19th, 1908.
Mr. Basom bought 1 heifer and 4 steers from Wm. Troutman November 11th, 1908.
Animals destroyed: 6 cattle.
Appraisement of animals, \$164.40.
57. H. N. Troutman, Upper Paxton township, Dauphin county.
Mr. H. N. Troutman purchased 3 steers from Wm. Troutman, which were removed November 17th, 1908. Leonard Pearson telephoned from Selins Grove, Snyder county, to C. F. Keiter, November 19th, 1908, to go to Millersburg and place these steers in quarantine, which was done the same day.
Quarantined by C. F. Keiter, November 19th, 1908, also by J. O. Reed, November 20th, 1908.
Animals destroyed: 3 cattle, 2 swine.
Appraisement of animals, \$126.
58. William Troutman, Chapman township, Snyder county.
Inspected by Leonard Pearson, A. R. Potteiger, O. G. Noack and E. S. Deubler.
Quarantined by Leonard Pearson November 18th, 1908.
Mr. Troutman took to his farm several cattle, part of which he delivered to purchasers already mentioned, and part of which he kept in his herd.
Animals destroyed: 11 cattle.
Appraisement of animals, \$271.97.
Total number of animals destroyed in the Middleburg outbreak: cattle, 140; swine, 78; sheep, 12.
Total appraisement of animals, \$4,707.39.

NORRISTOWN OUTBREAK.

Source: Putnam and Rood, of Sinclairville, N. Y., shipped from East Buffalo, N. Y., November 2nd, 1908, 22 cows and 4 calves to Ivan C. Walker, Norristown, Montgomery county, Pa. These cows were purchased from L. C. Faber, Marrilla, N. Y. They were originally yarded in the East Buffalo stockyards in pen No. 165, which is adjacent to the pens that were infected by cattle from Detroit. These cattle were unloaded in Norristown November 4th, at the unloading pens back of Walker's sale stable and were placed in cattle stalls in the basement of the sale stable. The cattle seemed to be out of condition; they were kept by Mr. Walker until November 11th, 1908, when they were sold. The 22 cows of this lot were sold November 11th as follows: Edwin Kelly, 10 cows; D. Davis, 7 cows; James Diamond, 1 cow; John Hassler, 1 cow; I. C. Walker, 3 cows. The day these cattle were received from Buffalo, some other cattle were sold from Walker's sale stable. The cattle that were sold were taken away, with a few possible exceptions, before the cattle from Buffalo were unloaded and put into the sale

stable. A cow that was sold November 4th, 1908, appears to have carried infection; probably there was delay in delivering this cow and she may not have been removed from the sale stable before the cattle from East Buffalo were delivered. The sale held November 11th, 1908, included not only the New York State cows but also 20 other cattle. Of the 43 cattle sold that day all but 2 developed foot-and-mouth disease. November 18th, 1908, there was another sale of 47 cattle; these were passed through the undisinfected pens that had been occupied by the cattle sold the week before; 25 of these developed foot-and-mouth disease and 22 did not.

Knowledge of this outbreak came from Dr. S. W. Mathues, of Concordville, who discovered foot-and-mouth disease in the herd of Elias Brous, Delaware county, and reported by telephone to the office of the State Veterinarian, November 19th, 1908. It was found that Mr. Brous had purchased from Edwin Kelly a cow that Kelly had bought at Walkers' sale November 11th, 1908.

The lists of animals sold at Walker's Bazaar November 4th, November 11th and November 18th, were obtained November 20th by Dr. Pearson and all of the animals that had been exposed were very promptly traced and quarantined, either closely, under foot-and-mouth disease quarantine, or provisionally, for observation. The cows that Kelly had sold were traced and quarantined by Dr. E. M. Michener and Dr. S. W. Mathues.

59. Pasquali Blasetti, Upper Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens November 23rd, 1908.
Mr. Blasetti bought 1 cow from I. C. Walker on November 18th, 1908.
Animals destroyed: 1 cow.
Appraisement of animal, \$22.
60. H. B. McClees, Philadelphia, Philadelphia county.
Inspected by J. S. Lacock and S. H. Johnson.
Quarantined by S. H. Johnson November 22nd, 1908.
Mr. McClees purchased 1 heifer from I. C. Walker, November 18th, 1908.
Animals destroyed: 15 cattle.
Appraisement of animals, \$683.
61. E. S. Keely, Worcester township, Montgomery county.
Inspected by J. S. Lacock and F. H. McKeown.
Quarantined by F. H. McKeown November 23rd, 1908.
Mr. Keely purchased a bull from I. C. Walker November 19th, 1908.
Animals destroyed: 27 cattle.
Appraisement of animals, \$557.
62. Frank Ross and Company, Upper Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens November 21st, 1908.
This firm purchased 2 cows from I. C. Walker, November 18th, 1908.
Animals destroyed: 63 cattle.
Appraisement of animals, \$725.50.

- A bull belonging to John M. Rex and 2 cows, one the property of Lewis Collins, the other of John Thomas, were in the premises of Frank Ross and Company when the quarantine order was served and were, of course, not permitted to leave the Ross premises.
63. John M. Rex, Upper Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens, November 21st, 1908.
Mr. Rex's bull was exposed to a cow belonging to Frank Ross and Company on November 18th, 1908.
Animals destroyed: 1 bull.
Appraisement of animal, \$28.
64. Lewis Collins, Upper Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens, November 28th, 1908.
Mr. Collin's cow was exposed November 18th, 1908, to cow purchased by Frank Ross and Company from I. C. Walker, November 18th, 1908.
Animals destroyed: 1 cow.
Appraisement of animal, \$50.
65. John Thomas, Upper Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens, November 21st, 1908.
Mr. Thomas' cow was on the Ross premises and was exposed for about two hours to the cow purchased by Frank Ross and Company from I. C. Walker, November 18th, 1908.
Animals destroyed: 2 cattle.
Appraisement of animals, \$55.
66. Alvin Haines, Plymouth township, Montgomery county.
Inspected and quarantined by J. S. Lacock, November 23rd, 1908.
Infection was carried to this herd by a cow which passed through the Walker stable in which the 26 cattle were stabled, that were received from Buffalo on November 5th, 1908, by I. C. Walker.
Animals destroyed: 14 cattle.
Appraisement of animals, \$610.
67. David Davis, Lower Providence township, Montgomery county.
Inspected by J. S. Lacock and A. E. Wight.
Quarantined by A. E. Wight, November 21st, 1908.
Mr. Davis purchased 7 cattle from I. C. Walker, November 11th, 1908.
B. J. Hilton, a tenant on the farm of Mr. Davis, was the owner of a goat which was destroyed on account of having been exposed to the Davis cattle.
Animals destroyed: 26 cattle, 1 goat, 7 swine.
Appraisement of animals, \$906.93.
68. James Diamond, White Marsh township, Montgomery county.
Inspected by J. Stewart Lacock and F. H. Jones.
Quarantined by F. H. Jones, November 21st and 24th, 1908.
Mr. Diamond bought a cow and calf from I. C. Walker, November 11th, 1908, Mr. Diamond, after moving the cow and calf to his premises, removed all the cows that were on his farm

- but two to another farm, perhaps to conceal them from inspectors. The animals removed were discovered three days after the two cows were inspected and quarantined.
- Animals destroyed: 10 cattle, 1 goat, 1 swine.
Appraisement of animals, \$310.
69. Serafino Lombardi, Plymouth township, Montgomery county.
Inspected by J. Stewart Lacock and F. H. McKeown.
Quarantined by F. H. McKeown, November 23rd, 1908.
Mr. Lombardi bought a cow from I. C. Walker, November 11th, 1908.
Animals destroyed: 15 cattle.
Appraisement of animals, \$395.
70. Daniel Malloy, Lower Merion township, Montgomery county.
Inspected by J. S. Lacock and F. L. Stevens.
Quarantined by F. L. Stevens, November 24th, 1908.
Mr. Malloy bought a cow from I. C. Walker, November 11th, 1908.
Animals destroyed: 1 cow.
Appraisement of animal, \$47.
71. Mrs. Charles B. Kelly, Plymouth township, Montgomery county.
Inspected by J. S. Lacock and F. W. Ainsworth.
Quarantined by F. W. Ainsworth, November 21st, 1908.
Infection was carried to this herd by a cow belonging to Mrs. Kelly that was placed in I. C. Walker's stable and exposed to the 26 cattle which came from Buffalo, November 5th, 1908. This cow was afterwards returned to the Kelly premises and placed with the Kelly herd, which afterwards developed foot-and-mouth disease.
Animals destroyed: 12 cattle.
Appraisement of animals, \$246.50.
72. Gaetano LeBue, Norristown, Montgomery county.
Inspected by J. S. Lacock, F. L. Stevens and F. W. Ainsworth.
Quarantined by F. W. Ainsworth and F. L. Stevens, November 22nd, 1908.
Mr. LeBue purchased one cow from I. C. Walker, November 11th, 1908.
Animals destroyed: 3 cattle.
Appraisement of animals, \$69.50.
73. I. C. Walker's farm, Norristown township, Montgomery county.
Inspected by Leonard Pearson and J. S. Lacock.
Quarantined by Leonard Pearson, November 20th, 1908.
Infection was carried to Mr. Walker's farm premises by three of the cattle received from Buffalo and unloaded at stockyards back of the sale barn, November 4th, 1908, and kept there until sold, November 11th, 1908.
Animals destroyed: 26 cattle, 25 swine.
Appraisement of animals, \$1,222.50.
74. John Haesler, 24th & Venango Sts., Philadelphia, Philadelphia county.
Inspected by J. S. Lacock and S. H. Johnson.
Quarantined by S. H. Johnson November 22nd, 1908.
Mr. Haesler purchased two cattle from I. C. Walker November 11th, 1908.

- Animals destroyed: 16 cattle, 1 goat.
Appraisement of animals, \$509.
75. Edwin Kelly, Williston township, Chester county.
Inspected by E. M. Michener, Leonard Pearson, J. S. Lacock and George W. Famous.
Quarantined by Leonard Pearson November 20th, 1908.
Knowledge of infection in this herd was obtained through the report from Dr. S. W. Mathues, of Concordville, of foot-and-mouth disease in the herd of Ellis Brous, Edgemont township, Delaware county. It was ascertained that the infection of Mr. Brous's herd came from cattle purchased from Edwin Kelly. It was found, as stated above, that the Kelly herd was infected from Walker's sale stables. Dr. Michener remained several days at the Kelly farm and was assisted by Mr. Kelly and his son in finding the cattle that they had sold after the arrival of the infected cattle from Norristown, and such cattle as had been exposed to contact with these cattle.
- Animals destroyed: 21 cattle, 2 swine.
Appraisement of animals, \$1,106.
76. James Bernard, Whitepain township, Montgomery county.
Inspected by J. S. Lacock and A. E. Wight.
Quarantined by J. S. Lacock, December 4th, 1908.
Infection was carried to this herd by a cow that Mr. Bernard purchased from C. B. Kelly (71), November 19th, 1908, and which was delivered to him November 20th, 1908. This cow while in Mr. Kelly's possession was exposed for a short time prior to November 16th, 1908, to I. C. Walker's cattle which were received from Buffalo November 5th, 1908. It is possible that infection was also carried to Mr. Bernard's herd by E. A. Rile who was present and examined without being clothed with the proper wearing apparel, the Edwin Kelly herd at Sugartown, November 23rd, the day it was destroyed. Dr. Rile, between November 23rd, the day on which the Kelly herd was destroyed, and December 3rd, examined on Mr. Bernard's premises the cow purchased by him from Mr. Kelly.
- Animals destroyed: 18 cattle.
Appraisement of animals, \$900.
77. Alfred Dallet, Thornbury township, Delaware county.
Inspected by G. W. Famous, A. N. Smith, E. M. Michener and S. W. Mathues.
Quarantined by S. W. Mathues, November 21st, 1908.
Mr. Dallet bought a cow from Edwin Kelly November 17th, 1908.
Animals destroyed: 21 cattle, 19 swine.
Appraisements of animals, \$1,428.50.
78. I. P. Thomas Estate, Thornbury township, Delaware county.
Inspected by E. M. Michener, S. W. Mathues and J. D. DeRonde.
Quarantined by S. W. Mathues, December 10th, 1908.
Infection was no doubt carried to this herd by Augustus Taney, manager, who visited the premises of and examined the cattle belonging to Alfred Dallet on November 16th, 1908, after which he returned home and examined the cattle belonging to the Thomas estate. In addition to the above exposure, these cattle pastured in a field adjoining the one in which

the Dallet cattle pastured. Again, chickens belonging to the two farms intermingled, and by so doing may have transmitted infection.

Animals destroyed: 55 cattle, 6 swine.

Appraisement of animals, \$3,138.

79. Thomas Kirk estate, Newton township, Delaware county.
Inspected by E. M. Michener, G. W. Famous, A. N. Smith, J. D. DeRonde.
Quarantined by E. M. Michener, November 21st, 1908.
Two cows were purchased by this estate from Edwin Kelly, November 17th, 1908.
Animals destroyed: 22 cattle, 1 goat.
Appraisement of animals, \$1,275.
80. J. Fred Lawton, Thornbury township, Delaware county.
Inspected by E. M. Michener, A. N. Smith, G. W. Famous, T. J. Kean and S. W. Mathues.
Quarantined by S. W. Mathues, November 22nd, 1908.
Mr. Lawton purchased a cow from Edwin Kelly November 16th, 1908.
Animals destroyed: 22 cattle, 3 swine.
Appraisement of animals, \$1,274.30.
81. George W. Proctor, Thornbury township, Delaware county.
Inspected by S. W. Mathues, E. M. Michener, G. W. Famous and J. Traum.
Quarantined by S. W. Mathues, November 22nd, 1908.
Infection was carried to Mr. Proctor's herd by a bull purchased by him from Edwin Kelly November 17th, 1908. This bull was in the possession of Mr. Kelly for a period of one month, and from November 11th, a period of six days, was exposed to the cattle purchased by Mr. Kelly from I. C. Walker November 11th, 1908.
Animals destroyed: 29 cattle.
Appraisement of animals, \$1,517.50.
82. Robert Yeardsley, Thornbury township, Delaware county.
Inspected by S. W. Mathues, E. M. Michener and J. Traum.
Quarantined by S. W. Mathues, November 21st, 1908.
Mr. Yeardsley purchased a cow from Edwin Kelly November 17th, 1908.
This cow was on Mr. Kelly's premises three weeks prior to the date on which it was sold, and from November 11th was exposed to the cattle purchased by Mr. Kelly from I. C. Walker.

cow being native. The source of infection and the history of this herd is of special interest from the fact that it was the first herd to be affected in Delaware county.

Animals destroyed: 14 cattle.

Appraisement of animals, \$780.

84. Elmer E. Miller, Edgemont township, Delaware county.
Inspected by G. W. Famous, E. M. Michener, T. J. Kean and J. D. DeRonde.
Quarantined by J. D. DeRonde and Geo. W. Famous, November 21st, 1908.
Mr. Miller bought three cows from Edwin Kelly, November 17th, 1908. These were three of the cows purchased by Mr. Kelly from I. C. Walker, November 11th, 1908.
Animals destroyed: 15 cattle, 2 swine.
Appraisement of animals, \$949.50.
Total number of animals destroyed in the Norristown outbreak: cattle, 475; swine, 67; goats, 3.
Total appraisements of animals, \$20,109.73.

LANCASTER OUTBREAK.

Source: Several consignments of cattle from East Buffalo, N. Y., to the Union stockyards, Lancaster, Penna. Shipments were made from East Buffalo stockyards to Lancaster during the time the Buffalo stockyards were infected, to B. N. Nolz, Z. Munich, F. C. Musser and M. M. Flickinger. These shipments made from October 17th to November 15th, 1908, comprised eighteen carloads. A large part of these cattle were from Michigan, a few from Indiana and a few from New York state. Three of the same shipments received a number of consignments of cattle from western New York state during the period referred to. It is not known that any of these New York state cattle that were shipped from points outside of Buffalo were exposed to foot-and-mouth disease, but it is possible that some of them may have been as they were within the Buffalo district and presumably were shipped in cars that were used in connection with the livestock traffic in the Buffalo stockyards.

It would seem to be probable that each of the four shippers named above, brought infected or exposed cattle from East Buffalo. The pens in the Lancaster stockyards are assigned to certain commission dealers, who use them exclusively; that is pens bearing certain numbers are used only for the business of certain commission dealers. It appears there was no great amount of infection in the Lancaster stockyards outside of the pens of the four commission men referred to, otherwise, cattle sold from pens of other dealers would have developed foot-and-mouth disease.

Through information obtained by Dr. B. F. Minich of Columbia, who had been instructed to trace and examine the cattle that had been shipped from East Buffalo and had been sold from the Lancaster stockyards. In the course of this investigation he learned of the infection in the herd of Jacob Hartman, November 18th, 1908. Infection in this herd was reported the next day by Dr. A. H. Metzger, of Millersville and Dr. B. H. Brady, of Lancaster, reported in a letter received November 10th, the existence of foot-and-mouth

disease in the herd of G. F. Murry, of Creswell. Following this a large force of State and federal inspectors were brought into Lancaster county and other points of infection were discovered as described below

85. Jacob Hartman, West Hempfield township, Lancaster county.
Inspected by B. F. Minich, A. H. Metzger, D. E. Hickman, Joseph Johnson and J. E. Bender.
Quarantined by B. F. Minich, November 18th, 1908.
Mr. Hartman purchased a bull from Harry Binkley, Mountville, Lancaster county, November 7th, 1908. This bull had been purchased by Binkley from M. M. Flickinger in the Lancaster stockyards about November 3rd. Mr. Hartman did not keep the bull as it was lame and he returned it to Binkley after he had had it about one week.
Animals destroyed: 22 cattle, 10 swine.
Appraisement of animals, \$1,154.
86. C. E. Greenawalt, West Hempfield township, Lancaster county.
Inspected by D. E. Hickman, B. F. Minich, Joseph Johnson and J. E. Bender.
Quarantined by D. E. Hickman November 21st, 1908.
The bull that was returned to Harry Binkley from Joseph Hartman was sold to C. E. Greenawalt November 17th. When the bull was taken to the Hartman farm, it was driven to the cattle pens at the hotel at Mountville. The same day that this bull was purchased Mr. Greenawalt purchased 2 steers from Walter Dunlap, Mountville stockyards, Lancaster county.
Animals destroyed: 3 cattle.
Appraisement of animals, \$135.
87. A. Z. Kline, West Hempfield township, Lancaster county.
Inspected by D. E. Hickman, B. F. Minich, J. Johnson and J. E. Bender.
Mr. Kline's cow was stabled on the Greenawalt farm.
Animals destroyed: 1 cow.
Appraisement of animal, \$55.
88. Dr. S. B. Koser, Drumore township, Lancaster county.
Inspected by F. B. Minich, D. E. Hickman and J. E. Bender.
Quarantined by B. F. Minich, November 20th, 1908.
Dr. Koser purchased two cows at Mountville from Harry Binkley November 8th, 1908, and had them driven to his farm near McCall's Ferry. They were stabled November 9th and 10th, at D. M. Witmer's farm near Safe Harbor. The two cows were purchased by Binkley from Jacob Hartman the same day they were sold to Dr. Koser; they were evidently infected in the Hartman herd.
Animals destroyed: 3 cattle.

90. D. M. Witmer, Manor township, Lancaster county.
Inspected by Joseph Johnson, B. F. Minich and J. E. Bender.
Quarantined by J. E. Bender, November 21st, 1908.
Two cows from the herd of Jacob Hartman, purchased by Harry Binkley and sold by him to Dr. S. B. Koser, were stabled on the premises and among the cattle of D. M. Witmer November 9th and 10th.
Animals destroyed; 1 cow, 3 swine.
Appraisement of animals, \$105.
91. George F. Murray, Manor township, Lancaster county.
Inspected by C. J. Marshall, J. Johnson and J. E. Bender.
Quarantined by C. J. Marshall November 20th, 1908.
Mr. Murry purchased 3 cows from Harry Binkley November 10th, 1908. The cows were bought from two farmers in the neighborhood whose herds were subsequently inspected and found to be free from any evidence of foot-and-mouth disease. These cows were put in the cattle pens at the Mountville Hotel where they came in contact with the cows from the Hartman herd that were sold by Binkley to Dr. Koser (No. 87).
Animals destroyed: 24 cattle, 17 swine.
Appraisement of animals, \$425.17.
92. John H. Gamber, Manor township, Lancaster county.
Inspected by H. B. Brady, C. J. Marshall and G. M. Graybill.
Quarantined by C. J. Marshall November 21st, 1908.
Mr. Gamber purchased 12 steers at the Lancaster stockyards October 28th, 1908, from B. N. Nolt. These steers were from a consignment of thirty-two head shipped from East Buffalo October 26th; they arrived in Lancaster the day they were sold to Gamber.
Animals destroyed: 18 cattle.
Appraisement of animals, \$730.
93. H. B. Ament, Manor township, Lancaster county.
Inspected by H. B. Brady, C. J. Marshall and G. M. Graybill.
Quarantined by C. J. Marshall November 21st, 1908.
Mr. Ament is employed by Mr. Gamber. His cattle were kept on the same premises as those of Gamber's. (No. 92).
Animals destroyed: 4 cattle, 5 swine.
Appraisement of animals, \$265.
94. Dr. E. E. Kindig, West Hempfield township, Lancaster county.
Inspected by B. F. Minich and J. E. Bender.
Quarantined by B. F. Minich November 29th, 1908.
Dr. Kendig purchased a bull at the Lancaster stockyards November 4th, from B. N. Nolt. This bull was of a consignment from East Buffalo that was shipped from there November 2d, 1908, and that arrived in Lancaster November 4th, 1908.
Animals destroyed: 6 cattle, 3 swine.
Appraisement of animals, \$330.
95. H. B. Esbenshade, Manheim township, Lancaster county.
Inspected and quarantined by G. M. Graybill November 22nd, 1908.
Mr. Esbenshade bought seven steers and two bulls from Z. Minich November 4th, 1908. These steers were shipped from Buffalo

November 2nd, and arrived at the Lancaster stockyards November 4th, 1908.

Animals destroyed: 20 cattle, 8 swine.

Appraisement of animals, \$984.

96. Amos B. Herr, East Hempfield township, Lancaster county. Inspected by G. M. Graybill, A. W. Wier and Leonard Pearson. Quarantined by G. M. Graybill November 22nd, 1908.

Mr. Herr purchased from Z. Minich one heifer and nine steers at the Lancaster stockyards. The heifer was purchased late in October and the steers were purchased November 4th. These cattle had been shipped from Michigan by way of Buffalo.

Animals destroyed: 26 cattle, 4 swine.

Appraisement of animals, \$1,454.

97. Charles Hambright, Manheim township, Lancaster county. Inspected by W. B. M. Strayer, C. M. Wright, A. W. Wier and Leonard Pearson.

Quarantined by C. M. Wright November 29th, 1908.

Mr. Hambright's cattle are located on a farm about a mile east of the Lancaster stockyards. Mr. Hambright kept a large number of pigeons. No cattle were brought to the farm after August 1st. November 10th, 1908, Mr. Hambright purchased a fat hog at the Lancaster stockyards and killed it the same day for his own use. There is a fountain of good drinking water in the barnyard where the Hambright cattle were kept. It is said that it has been a regular custom of the employes of the railroad in that vicinity to obtain their drinking water in this place. As the fountain is quite near where the bars are shifted, manure may be shaken from the cars, dropped on the tracks and be carried into the barnyard by the considerable traffic. The exact mode of infection in this case was not determined. When the disease was reported November 28th, the symptoms were in the earlier and acute stage. The infection may have been brought to the farm from one to two weeks before the outbreak was reported.

Animals destroyed: 14 cattle, 17 swine.

Appraisement of animals, \$687.

98. John R. Leaman, East Lampeter township, Lancaster county. Inspected by D. E. Hickman, Francis Falls, A. W. Wier, John Reichel, Leonard Pearson, J. H. Turner and Joseph Johnson. Quarantined by D. E. Hickman, January 17th, 1909.

Infection in this herd was reported to the office of the State Livestock Sanitary Board at Lancaster, by W. B. M. Strayer, January 17th, 1909. When examined the same day the cattle were found to be afflicted with foot-and-mouth disease in all stages. The herd had apparently been infected about three weeks at the time of inspection. No animal had recently been taken to this herd excepting a cow moved on permit December 26th, 1908. The origin of this cow was known. After the disease appeared in Mr. Leaman's herd, the herd from which the cow came was inspected as were other herds in that neighborhood, and other cattle that had been in contact with this cow before it reached Leaman's farm, and no evi-

dence of foot-and-mouth disease was discovered in any of these animals. Moreover, this cow showed evidence of more recent disease as did some other cows of the Leaman herd.

Mr. Leaman's farm is about one mile across country from the Hambright farm. The two farms are separated by the Conestoga creek. Mr. Hambright (No. 96), kept a large flock of pigeons. An effort was made to destroy these pigeons when the cattle were killed, but this was not possible. They were shot at and many of them flew away. Mr. Leaman also kept a large flock of pigeons. These nested all around the buildings; under the eaves. It seems to be probable that the infection was carried from the Hambright farm to the Leaman farm by the pigeons.

Animals destroyed: 28 cattle, 5 swine.

Appraisement of animals, \$1,490.

99. John N. Landis, East Lampeter township, Lancaster county.
Inspected and quarantined by Leonard Pearson and S. E. Bennett, January 18th, 1909.

The Landis cattle were watered from a brook a quarter of a mile below the Leaman premises. The young man on Mr. Landis' farm worked at corn shedding at the Leaman farm two or three weeks before. There are many pigeons on the Landis premises as well as on the Leaman farm. During the two weeks prior to the occurrence of the disease and following a heavy snow storm, Mrs. Landis observed strange pigeons in the cow stable eating from the mangers. The state of the disease at the time of the first inspection was very recent. The cows showed perfectly fresh vesicles and one a high temperature. It is clear that the Landis cattle were infected after the Leaman cattle, and everything points to the carrying of infection from the Leaman farm to the Landis farm.

Animals destroyed: 4 cows.

Appraisement of animals, \$230.

100. Irwin H. Forry, Manheim township, York county.
Inspected by W. L. Herbert, W. C. Herrold, J. F. Fahey and G. M. Graybill.

Quarantined by W. C. Herrold November 28th, 1908.

Twenty-four steers were purchased by B. F. Forry, father of E. H. Forry, from F. C. Musser at the Lancaster stockyards, October 26th, 1908. These cattle were shipped via P. R. R., to Spring Grove; unloaded October 27th, and driven to Mr. Forry's farm. The cattle were not known to be affected at the time of purchase.

Animals destroyed: 30 cattle, 9 swine.

Appraisement of animals, \$1,334.

Total number of animals destroyed in Lancaster outbreak:
cattle, 205; swine, 86.

Total appraisement of animals, \$9,521.17.

APPENDIX A.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Notice of Quarantine.

WARNING.

ENTRANCE FORBIDDEN!

Cattle affected with or believed to have been exposed to
**APHTHOUS FEVER OR CONTAGIOUS
FOOT-AND-MOUTH DISEASE**

are (or have been) on these premises and a quarantine has been established of the cattle, hogs, sheep and goats, and the premises, including buildings, yards, pens and fields that such animals occupy or have occupied. All unauthorized persons are forbidden to enter the quarantined premises or to come in contact with the diseased or exposed animals, or with any object or thing that may have been contaminated by or from such animals. The following is an extract from the Act of Assembly, approved May 21st, 1895:

APPENDIX B.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

ORDER OF QUARANTINE.**Foot-and-Mouth Disease.**

To *P. O.,*
..... *Co., Pa.*

You are hereby notified that in accordance with the provisions of the Act of May 21st, 1895, and the regulations of the State Livestock Sanitary Board, you are required to isolate and place in quarantine on your premises, the following described animal. :

.....
.....
under suspicion of being affected with or having been exposed to the disease known as aphthous fever or foot and mouth disease, a dangerous, contagious disease.

You are hereby forbidden to remove from said premises any of the above described animals, or any animal, material, article or thing that is likely to or may convey contagion.

This quarantine remains in force until it is revoked by authority of the State Livestock Sanitary Board.

You will be governed by the following regulations of the State Livestock Sanitary Board.

1. Cattle, sheep, goats and swine under quarantine on account of foot and mouth disease must be kept absolutely and wholly separate and apart from all other animals and all other animals must be kept wholly apart from quarantined animals.

2. The quarantine is extended to animals other than those originally quarantined, if they are permitted to come in contact with quarantined animals or to enter quarantined premises.

3. Persons caring for animals quarantined on account of foot and mouth disease must not, under any circumstances, come in contact, either direct or indirect, with other cattle, sheep, goats or swine.

4. No animals shall be allowed to run loose or free on or near quarantined premises. This regulation covers domesticated animals of all kinds, including dogs, cats and poultry.

5. If there are pigeons on a farm or on premises quarantined on account of foot and mouth disease the pigeons shall be killed or they shall be confined on the said quarantined premises until released by authority of an agent of the State Livestock Sanitary Board.

6. If domesticated animals, dogs, cats, poultry or pigeons are kept at liberty or allowed to go free so near quarantined animals or premises that they constitute, in the estimation of an agent of the State Livestock Sanitary Board, a menace to the efficiency of the quarantine, such animals may be confined and placed under quarantine.

7. Milk from diseased or exposed cows or milk produced in or on quarantined premises shall be placed in milk cans, or other receptacles that have covers that fit tightly. Formaldehyde shall be added to such milk in the proportion of one pint of formaldehyde to thirty quarts of milk. The cover shall then be placed on the can or receptacle and the milk and the formaldehyde shall be allowed to remain in the cow stable, undisturbed, for not less than eight hours, after which it is to be poured into a pit dug in the manure pile and covered over with manure. The agent of the State Livestock Sanitary Board may authorize other safe methods for disposing of such milk.

8. There shall not be removed from quarantined premises, without specific permission in writing, from an authorized representative of the State Livestock Sanitary Board, any material, article or thing that is likely to or that may convey contagion, and, in particular, there shall not be removed from such premises any milk or milk products; diseased or quarantined animals; hay, straw, fodder, grain or other feed; manure, stable or milk utensils.

9. Horses that are to be used must be kept in a stable separate from the buildings and premises under quarantine. Before removal to such stable, the horses shall be thoroughly cleaned, their feet and legs shall be disinfected and the halters and harness shall be disinfected, under the supervision of an agent of the State Livestock Sanitary Board.

10. Persons caring for quarantined animals must not convey or permit the conveyance, from the quarantined premises, of articles, materials or things that have been in contact with or are contaminated by or that may have been contaminated by diseased animals.

11. All unauthorized persons are forbidden to enter quarantined premises or to come in contact with diseased or exposed animals, or with any object or thing that may have been contaminated by, or from, such animals.

Your attention is directed to the following Section of the Act of May 21st, 1895:

"Section 5. That any person or persons, wilfully violating any of

Served or delivered } State Veterinarian.
..... 190 ..} By
..... Agent of the State Livestock Sanitary Board

To be Detached and Returned to State Veterinarian.

I have this day delivered to a quarantine
order covering the following animals:
the property of of P. O., Co., Pa.

Agent, State Livestock Sanitary Board.

Date.....190....

APPENDIX C.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Circular No. 14.

Instructions to Agents of the State Livestock Sanitary Board Who are Engaged in Work Upon the Control of Foot and Mouth Disease.

Harrisburg, Pa., November 11, 1908.

1. If there is any reason to suspect that any animals are affected with foot and mouth disease in a herd that is to be inspected, the veterinarian should wear special clothing provided for this purpose. If by chance, a veterinarian should come in contact with an animal affected with foot and mouth disease when he is not clad as described below, he must at once disinfect his hands, boots and

clothing as well as possible and remain away from the vicinity of healthy cattle, sheep, goats or swine until after all of his clothing has been disinfected by fumigation.

2. Special clothing for use in the examination of animals affected with foot and mouth disease consists of a coat with a smooth rubber surface and so long as to come within ten inches of the ground; rubber boots, with extension tops to extend up the thighs; rubber gloves and a rubber hat or a cotton cap, which, after use, may be soaked in an antiseptic solution.

3. In using the special clothing mentioned in paragraph 2, the tops of the boots should be drawn up, the coat should be tightly buttoned and the sleeves should be closed at the bottom over the wrist of the rubber gloves before the veterinarian enters the premises where the infected animals may be. Before entering the premises, it is invariably necessary to provide and have ready for use a solution of bichloride of mercury, one part to three hundred. After entering the infected premises, the rubber coat must not be unbuttoned (nothing can be taken from the pockets), until after the clothing is disinfected as provided in paragraph 4.

4. When the veterinarian leaves the building or pen occupied by the affected animal or animals he should first disinfect his rubber gloves and the entire surface of the coat by washing with a sponge and the antiseptic solution. It will be convenient to have help to wash off the back, shoulders and sides of the coat. Special attention should be given to the removal of infectious material that may have lodged on the front of the coat or the sleeves. After the coat has been cleaned, it may be removed, then the boots should be washed from the top down to and including the soles and heels, after which the hat should be washed or soaked in the antiseptic solution. Lastly, the rubber gloves should be removed and the clothing put away in a suitable case or bag. The whole kit is to be fumigated with formaldehyde at the close of the day's work.

5. The typical cases of foot and mouth disease cannot fail to be recognized but as the evidence is in some cases indistinct (early in the disease, mild cases, recovering animals), certain special points are here mentioned. The discovery of mild cases is very important as these convey infection and may not have been suspected by the purchaser or owner. In examining cattle for evidence of foot and mouth disease, it is well to begin by taking the temperature. The febrile stage of the disease is very short, however, and sometimes immediately upon the formation of vesicles, in other cases very shortly thereafter, the temperature falls almost or quite to normal. The vesicles should be looked for closely as unless large they may be unobserved. Vesicles may sometimes be found well back on the

Where the animal has been long affected and is partly or almost recovered one should search carefully for defects in the mucous membrane, especially upon the back and tip of the tongue, the pad, inside the upper lip and the gum border back of the incisors. The feet and teats should also be closely examined in such cases. The condition of the mucous membrane that reveals the preexistence of lesions of foot and mouth disease may consist in only a very slight depression with an abrupt border; sometimes this is of considerable area. The appearance is as though the epithelium had been peeled off. Ulcers that have healed show for some time as areas of dirty yellow color, irregular shape and uneven surface; they are most numerous on the pad, the tips of the tongue, inside the upper lip, the lip borders and on the hard palate.

6. If any affected animals are found in a herd, or if animals from an infected herd have been brought into the herd under inspection, the entire herd is to be placed in quarantine by the service of a quarantine notice upon the owner or his representative. Official placards (notices of quarantine), are to be posted wherever the disease is found or is known to have existed and are to remain until the premises are disinfected and released from quarantine.

7. Agents of the State Livestock Sanitary Board will explain to herd owners the necessity for the stringent quarantine that is required. Owners and those in charge of infected herds and premises should also be very fully instructed as to the necessity for observing all of the regulations governing quarantine that are printed on the quarantine blank.

8. When the cattle are quarantined, each is to be tagged and each is to be described in the first report following the quarantine of the herd.

9. Inquiry should be made in all cases as to the source of the infection. As much information on this point as possible should be secured, with all obtainable details as to dates, place of origin, name of seller, route of shipment, initials and numbers of cars, description of animals, etc. The road over which the first infected animal passed on its way to the infected herd should be ascertained, together with such other information as can be had in relation to the possibility of contact on the way to the infected farm. Careful inquiry should also be made as to whether any animals had been sold from the infected herd or whether outside animals (cattle, sheep, goats or swine), have come in contact with the members of the infected herd since the arrival of the animal which is presumed to have introduced the infection.

10. When quarantine herds or premises are reinspected, the veterinarian should ascertain how thoroughly the quarantine regulations are being observed. Defects in observation should be pointed out to the owner of the premises or person in charge, and should be mentioned in the veterinarians' report.

11. From time to time, the tagged cattle in quarantine herd should be looked up and compared, as to descriptions and tag numbers, with the original list.

12. All reports or rumors of the existence of foot and mouth disease in other places should, if possible, be investigated; if this cannot be done they should be reported.

13. Sheep, goats and swine on infected premises are to be quarantined and subjected to regulations and conditions similar to those governing cattle.

14. Veterinarians undoubtedly will work in full sympathy, and they should use every effort to work in co-operation and complete harmony with the owners of infected herds. The very dangerous nature of the disease and the enormous losses that are sure to result if its prevalence continues (as all the history of this disease teaches, in this and other countries), should be explained to livestock owners.

LEONARD PEARSON,
State Veterinarian.

APPENDIX D.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., November 13, 1908.

WHEREAS: Aphthous fever or foot and mouth disease has occurred among cattle in the counties of Montour, Northumberland and Union, and it is deemed that cattle in the county of Columbia may have been exposed, and

WHEREAS: Foot and mouth disease is a dangerous and highly contagious disease affecting cattle, sheep, goats and swine, and it is of very great importance to the livestock interests of the State and nation that this outbreak shall be controlled and eradicated, and

WHEREAS: The State Livestock Sanitary Board is charged with the control of contagious diseases among domestic animals in Pennsylvania and is authorized and empowered by the Act of May 21st, 1895, to establish, maintain, enforce and regulate such quarantine and other measures relating to the movements of animals and their products as may be necessary for carrying out the purposes of the said Act, therefore,

IT IS HEREBY ORDERED, First: To prevent the spread of foot and mouth disease, and to aid in its eradication, no cattle, sheep, goats or swine shall be moved from or out of the counties of Columbia, Montour, Northumberland and Union.

Second: No cattle, sheep, goats or swine shall be moved into any one of the counties of Columbia, Montour, Northumberland or Union except for immediate slaughter.

All transportation companies, cattle dealers, farmers and others are called upon to assist the State Livestock Sanitary Board in the enforcement of the foregoing order of quarantine so that this outbreak of disease may be eradicated with the least possible loss and in the shortest possible time.

APPENDIX E.

PENNSYLVANIA STATE LIVESTOCK SANITARY BOARD.

Foot and Mouth Disease.—Inspection Report.

County,
Township,
Farm Owner,
Farm Occupant,
P. O. Address,
Number and kind of Cattle, Sheep, Goats and Swine,
.....
.....
Were all of the above animals seen and examined?
Give number and origin of all animals brought to farm since October 20th, 1908,
.....
Give number and destination of all animals removed from farm since October 20th, 1908,
.....
Has anything been brought from infected premises to this farm?
Any history or present evidence of foot and mouth disease?
Date. 190
Veterinary Inspector.

APPENDIX F.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, November 24th, 1908.

WHEREAS: Aphthous fever or foot and mouth disease has occurred among cattle in the counties of Clinton, Union, Snyder, Juniata, Montour, Northumberland, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware and Philadelphia, and

WHEREAS: Foot and mouth disease is a dangerous and highly contagious disease affecting cattle, sheep, goats and swine, and it is of very great importance to the livestock interests of the State and nation that this outbreak shall be controlled and eradicated, and

WHEREAS: The State Livestock Sanitary Board is charged with the control of contagious diseases among domestic animals in Pennsylvania and is authorized and empowered by the Act of May 21st, 1895 to establish, maintain, enforce and regulate such quarantine and other measures relating to the movements of animals and their products as may be necessary for carrying out the purposes of the said Act, therefore,

IT IS HEREBY ORDERED, First: To prevent the spread of foot and mouth disease, and to aid in its eradication, no cattle, sheep, goats or swine shall be moved from or out of the counties of Clinton, Union, Snyder, Juniata, Montour, Northumberland, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware or Philadelphia.

Second: No cattle, sheep, goats or swine shall be moved into any one of the counties of Clinton, Union, Snyder, Juniata, Montour, Northumberland, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware or Philadelphia except for immediate slaughter.

All transportation companies, cattle dealers, farmers and others are called upon to assist the State Livestock Sanitary Board in the enforcement of the foregoing order of quarantine so that this outbreak of disease may be eradicated with the least possible loss and in the shortest possible time.

APPENDIX G.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, November 24th, 1908.

RESOLVED: On account of the prevalence of foot and mouth disease a quarantine is hereby established of all public roads and highways in so far as concerns the use of such public roads and highways for the driving, movement or transportation of cattle, sheep, goats or swine in the following named counties to-wit: Clinton, Union, Snyder, Juniata, Montour, Northumberland, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware and Philadelphia.

IT IS FORBIDDEN to drive, transport or move cattle, sheep, goats or swine over or upon public roads or highways in the counties aforesaid except upon specific permission in writing from an authorized agent of the State Livestock Sanitary Board.

Permits for driving, transporting or moving cattle, sheep, goats or swine over the public roads or highways must be taken out in advance and must be held by the person in charge of and accompanying such animals, and must be kept available for inspection.

All sheriffs, constables, police officers and officers of the law are called upon to assist in the enforcement of these quarantine regulations.

APPENDIX H.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., November 30, 1908.

IT IS HEREBY ORDERED: That no hides or skins which have been removed from the carcasses of cattle (including calves), sheep, other ruminants and swine in the counties of Clinton, Union, Snyder, Juniata, Montour, Northumberland, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware and Philadelphia, shall be dipped or transported from these counties to any other section of the State unless they are previously immersed in a five per cent. solution of carbolic acid, or a 1 to 1,000 solution of bichloride of mercury, or a three per cent. solution of formalin, containing a thirty-seven per cent. solution of formaldehyde.

This immersion must take place in the presence of an agent of the State Livestock Sanitary Board or of an inspector of the U. S. Bureau of Animal Industry, and no hides or skins of the animals mentioned above shall be accepted for shipment without a certificate signed by an agent of the State Livestock Sanitary Board or an employee of the U. S. Bureau of Animal industry that they have been disinfected as required by this order.

Harrisburg, Pa., December 8, 1908.

SUPPLEMENTAL TO THE ORDER OF NOVEMBER 30, 1908, IN RELATION TO THE SHIPMENT OF HIDES AND SKINS OUT OF THE COUNTIES UNDER FOOT-AND-MOUTH DISEASE QUARANTINE:

In addition to the methods for disinfecting hides and skins permitted by the above order, the following is approved, with the concurrence of the U. S. Bureau of Animal Industry: Dry sheep skins may be fumigated with formaldehyde gas instead of being dipped. In this case, the skins are to be hung loosely on racks or lines, so that the gas may penetrate between them; they shall be exposed

to fumigation in a tight room; formaldehyde gas shall be liberated from formaldehyde solution by the use of permanganate of potash; for each 1,000 cubic feet capacity of the disinfecting chamber there shall be used 20 ounces of formaldehyde solution (37-40 per cent.), and 16 2-3 ounces of permanganate of potash; exposure to fumigation shall continue not less than eight hours.

APPENDIX I.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., December 22nd, 1908.

The following order was adopted by the State Livestock Sanitary Board at Harrisburg this date, to become effective December 28th, 1908, and to supersede the two orders adopted by this Board on November 24th, 1908:

WHEREAS: Aphous fever, or foot-and-mouth disease, has occurred among cattle in the counties of Clinton, Lycoming, Union, Snyder, Juniata, Montour, Northumberland, Perry, Dauphin, York, Lancaster, Lehigh, Montgomery, Chester, Delaware and Philadelphia, and

WHEREAS: The State Livestock Sanitary Board is charged with the control of contagious diseases among domestic animals in Pennsylvania and is authorized and empowered by the Act of May 21st, 1895, to establish, maintain, enforce and regulate such quarantine and other measures relating to the movements of animals and their products as may be necessary for carrying out the purposes of the said Act, therefore,

IT IS HEREBY ORDERED, To prevent the spread of foot-and-mouth disease and to aid in its eradication, no cattle, sheep, goats or swine shall be moved from or out of the following counties or touching to any other part of the State. the counties of Montour

townships of Upper Paxton and Halifax; Provided, however, That cattle, sheep, goats or swine may be moved from one point to another within the aforementioned quarantined area upon permission in writing from an agent of the State Livestock Sanitary Board, expressly authorized to issue such permits.

IT IS FORBIDDEN to drive, transport or move cattle, sheep, goats or swine over or upon public roads or highways in the counties and townships aforesaid except upon specific permission in writing from an agent of the State Livestock Sanitary Board expressly authorized to issue such permits.

Permits for driving, transporting or moving cattle, sheep, goats or swine over the public roads or highways must be taken out in advance and must be held by the person in charge of and accompanying such animals, and must be kept available for inspection.

All sheriffs, constables, police officers and officers of the law are called upon to assist in the enforcement of these quarantine regulations.

APPENDIX J.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., January 5th, 1909.

The following order was adopted by the State Livestock Sanitary Board at Harrisburg this date to supersede the order adopted by this Board on December 28th, 1908:

WHEREAS: The Secretary of the U. S. Department of Agriculture has issued amendment No. 9, effective to-day, modifying B. A. I. order No. 156, quarantining Pennsylvania on account of foot-and-mouth disease, in so far as to permit the movement of cattle, calves, sheep, and swine for immediate slaughter, of hay, straw, or similar fodder, and of hides, skins, and hoofs of cattle, sheep, other ruminants and swine from any point in the State of Pennsylvania except from the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Center, Union, Snyder, Mifflin, Juniata and Perry, and that portion of York county which lies east and south of Conewago creek, to any point located in any other State or Territory or the District of Columbia, without inspection or certification, provided the authorities of the State, Territory, or the District of Columbia to which the animals are destined have previously signified their willingness to accept such animals; and provided, further, that animals moved under this amendment shall not be trailed into or driven through any one of the aforesaid counties or part of county in the State of Pennsylvania, and that no cattle, sheep, other ruminants

nants, or swine shall be trailed or driven from the State of Pennsylvania until permission for such movement has first been obtained from the Chief of the Bureau of Animal Industry, and

WHEREAS: The said amendment has been issued under the condition that the State Livestock Sanitary Board will establish and maintain a quarantine prohibiting the movement of cattle, sheep, other ruminants, and swine from or out of any of the counties or part of county aforementioned to any other part of the State; and of hay, straw, and similar fodder, or hides, skins, and hoofs of cattle, sheep, other ruminants and swine, unless disinfected, therefore,

IT IS HEREBY ORDERED that no cattle, sheep, other ruminants and swine shall be moved from the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Center, Union, Snyder, Mifflin, Juniata and Perry, and that portion of York county which lies east and south of Conewago creek to any other part of the State; and that no hay, straw, and similar fodder, or hides, skins and hoofs of cattle, sheep, other ruminants and swine shall be moved from the counties or part of county aforementioned to any other part of the State unless disinfected, and

IT IS FURTHER ORDERED, To prevent the spread of foot-and-mouth disease and to aid in its eradication, no cattle, sheep, goats, or swine shall be moved from or out of the following counties or townships to any other part of the State: the counties of Montour, Northumberland, Lancaster, Lehigh, Montgomery, Chester, Delaware and Philadelphia; in Clinton county, the townships of Porter, Lamar, Wayne, Dunstable, Woodward, Castanea, Bald Eagle and Allison, the Boroughs of Mill Hall and Flemington, and the city of Lock Haven; in Lycoming county, the seventh and eleventh wards of the city of Williamsport; Union county, except Hartley and Lewis townships; Snyder county, except West Beaver and Spring townships; that part of Juniata county situated north and east of the Juniata river, except Fermanagh and Walker townships; that part of York county situated east and south of Conewago creek; in Perry county, the townships of Liverpool and Buffalo; and in Dauphin county, the townships of Upper Paxton and Halifax; Provided, however, that cattle, sheep, goats, or swine may be moved from one point to another within the aforementioned quarantined area upon permission in writing from an agent of the State Livestock Sanitary Board expressly authorized to issue such permits.

IT IS FORBIDDEN to drive, transport or move cattle, sheep, goats or swine over or upon public roads or highways in the coun-

APPENDIX K.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., January 13, 1909.

The following order referring to the movement or transportation of hides and skins within the State was adopted by the State Livestock Sanitary Board to-day and is supplemental to the order adopted January 5th:

Hides or skins removed after January 1st from cattle, calves, sheep, or goats slaughtered in the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Center, Union, Snyder, Mifflin, Juniata and Perry, and that portion of York county which lies east and south of Conewago creek (and all other parts of Pennsylvania), may be moved to other parts of the State without disinfection provided the said hides or skins have not been in contact with hides or skins from animals slaughtered within the above described district before January 1st.

Hides or skins removed from animals slaughtered before January 1st and now stored in slaughter houses under the inspection of the U. S. Bureau of Animal Industry where the animals killed have come from unquarantined districts may be moved without disinfection.

Hides or skins from animals slaughtered before January 1st may be shipped without disinfection from points within the district in Pennsylvania quarantined by the U. S. Department of Agriculture to tanneries at any point within the state upon permission in writing from an authorized agent of the State Livestock Sanitary Board.

APPENDIX L.

Commonwealth of Pennsylvania.

STATE LIVESTOCK SANITARY BOARD.

Harrisburg, Pa., February 24, 1909.

A. The following order was adopted by the State Livestock Sanitary Board this date to supersede previous orders issued on account of foot-and-mouth disease.

B. WHEREAS, The Secretary of the United States Department of Agriculture has issued a quarantine order (B. A. I. Order No. 157), to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants and swine, effective on and after February 25th, 1909, which provides as follows:

**U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 24, 1909.**

1. In order to prevent the further spread of foot-and-mouth disease among livestock, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by Section 1 of the Act of Congress, approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area to wit:

2.

PENNSYLVANIA.

The entire County of PHILADELPHIA, including the City of Philadelphia.

The township of Hereford in BERKS County.

The townships of MILFORD, Richland and Springfield, and the boroughs included therein, in BUCKS County.

The townships of Marion and Walker in CENTRE County.

The townships of Pine Creek, Dunstable, Woodward, Allison, Bald Eagle, Porter, Lamar, Castanea and Wayne, the Boroughs of Mill Hall and Flemington, and the city of Lock Haven in CLINTON County.

The townships of Hemlock and Montour in COLUMBIA County.

The townships of Upper Paxton and Halifax, and the boroughs included therein, in DAUPHIN County.

The townships of East Whiteland, Tredyffrin, East Town, Willistown, East Goshen, West Town, Thornbury and Birmingham, and the boroughs and cities included therein, in CHESTER County.

The townships of Radnor, New Town, Marple, Haverford, Edgmont, Upper Providence, Thornbury, Middletown, Birmingham, Concord and Aston, and the boroughs of Glenolden and Media, in DELAWARE County.

That portion of JUNIATA County lying north and east of the Juniata River.

The townships of East Donegal, Ralpho, Penn, Warwick, West Earl, Upper Leacock, Leacock, East Lampeter, Manheim, East Hempfield, West Hempfield, Manor, Lancaster, Pequea, West Lampeter, Strasburg, Providence, Conestoga, Martick and Drumore, and the boroughs and the city of Lancaster included therein, in LANCASTER County.

All of LEHIGH County, excepting Hanover Township, and the boroughs of Catasauqua and West Bethlehem included therein.

The City of Williamsport in LYCOMING County.

The townships of Upper Hanover, Skippack, Towamensing, Upper Gwynedd, Lower Gwynedd, Whitepain, Worcester, Lower Providence, Upper Merion, Norriton, Plymouth, Upper Dublin, White Marsh, Lower Merion and Springfield, and all boroughs and cities included therein, and also that portion of the borough of Lansdale lying in Hatfield Township, in MONTGOMERY County.

The townships of Anthony, Limestone, Valley, West Hemlock, Cooper, Mahoning and Mayberry, and the borough of Danville, in MONTOUR County.

The township of Lower Saucon, and the boroughs of South Bethlehem and Hellertown, in NORTHAMPTON County.

The townships of Delaware, Lewis, Turbut, West Chillisquaque, East Chillisquaque, Point, Upper Augusta, Gearhart, Rush, Ralpho, Shamokin and Rockefeller, and the boroughs and cities included therein, in NORTHUMBERLAND County.

All of SNYDER County, excepting Monroe, Spring and West Beaver townships.

All of UNION County, excepting Lewis and Hartley townships.

The townships of Codorus and Manheim, and the boroughs included therein, in YORK County.

3. (Relates to New York.)

4. (Relates to Michigan.)

5. (Relates to Maryland.)

6. During the existence of this quarantine, the interstate or foreign transportation movement of cattle, swine, other ruminants

8. Upon inspection and certification by an employee of the Bureau of Animal Industry, cattle, sheep, other ruminants and swine from points in the area herein quarantined, may be moved interstate, for immediate slaughter, provided the authorities of the State, Territory or District of Columbia, to which the animals are destined, have previously signified their willingness to accept them. When shipments by rail of cattle, sheep, other ruminants and swine, for immediate slaughter, are made from points in the area herein quarantined, the cars or crates containing them shall be sealed with Department seals, affixed by an employee of the Bureau of Animal Industry, before the said cars or crates shall be allowed to leave the area herein quarantined; and such shipments shall not be unloaded en route or at destination, within or outside of the area herein quarantined, except into reserved pens, which have been designated and approved for that purpose by the Chief of the Bureau of Animal Industry. The specially cleaned and disinfected pens provided for in Section 7 of this Order shall not be used for this class of shipments. When such shipments are unloaded en route, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars or crates containing such shipments shall remain sealed until the animals arrive at the place of slaughter.

9. Cattle, sheep, other ruminants and swine intended for purposes other than slaughter may be moved interstate from the area herein quarantined only upon permission of the Secretary of Agriculture first had and obtained, and under such restrictions as he may impose in each case.

10. Hides, skins and hoofs removed after January 1, 1909, from the carcasses of cattle, calves, sheep or goats, slaughtered within the area herein quarantined, may be moved interstate, without disinfection or certification, subject to permission of the State authorities at destination, provided that the said hides, skins or hoofs have not been in contact with hides, skins or hoofs from the carcasses of animals slaughtered before January 1, 1909, within the area herein quarantined.

11. Hides, skins and hoofs of cattle, calves, sheep and goats, which originated outside of the area herein quarantined, and which have been removed from carcasses prior to January 1, 1909, at establishments having inspection under the Federal Meat Inspection law, may be moved interstate from the area herein quarantined without disinfection or certification, subject to the permission of the State authorities at destination, provided that such hides, skins or hoofs have not been in contact with other hides, skins or hoofs removed prior to January 1, 1909, and which are in the area herein quarantined.

12. Hides, skins and hoofs of cattle, sheep and goats which are within the area herein quarantined, but which are not heretofore provided for in this Order, shall be disinfected under the supervision of, and be certified by an employee of the Bureau of Animal Industry before being moved interstate from the area herein quarantined.

13. Hay, straw and similar fodder may be moved interstate from the area herein quarantined only upon certification by an employee of the Bureau of Animal Industry.

14. Rule 6, Revision 1, dated November 19, 1908, effective on and after November 19, 1908, and all amendments thereto, being amendments 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11, shall cease to be effective on and after February 25, 1909, on and after which date this Rule 6, Revision 2, which, for purposes of identification is designated as B. A. I. Order 157, and which is subject to amendment or revision on statutory notice, shall become and be effective until otherwise ordered.

C. WHEREAS, the said quarantine order of the Secretary of the United States Department of Agriculture has been issued under the condition that the Pennsylvania State Livestock Sanitary Board will establish and maintain a quarantine prohibiting the movement of cattle, sheep, other ruminants and swine, or of hay, straw or similar fodder, hides, skins, or hoofs of cattle, sheep, other ruminants and

In CENTRE County, the townships of Marion and Walker.

In CLINTON County, the townships of Porter, Lamar, Wayne, Dunstable, Woodward, Castanea, Bald Eagle, Allison and Pine Creek, the boroughs of Mill Hall and Flemington, and the City of Lock Haven;

In COLUMBIA County, the townships of Hemlock and Montour;

In CHESTER County, the townships of East Town, Tredyffrin, East Whiteland, Willistown, East Goshen, West Town, Thornbury, and Birmingham and the boroughs included therein;

In DAUPHIN County, the townships of Upper Paxton and Halifax, and the boroughs included therein.

In DELAWARE County, the townships of Haverford, Radnor, Newtown, Marple, Upper Providence, Edgemont, Middletown, Aston, Concord, Thornbury and Birmingham and the borough of Media;

In JUNIATA County, that portion of the county lying north and east of the Juniata River;

In LANCASTER County, the townships of East Donegal, Rapho, Penn, Warwick, West Earl, Upper Leacock, Leacock, East Lampeter, Manheim, East Hempfield, West Hempfield, Manor, Lancaster, Pequea, West Lampeter, Strasburg, Providence, Conestoga, Martick and Drumore, and the boroughs and the City of Lancaster included therein.

In LEHIGH County, the entire county, excepting Hanover township and the boroughs of Catasauqua and West Bethlehem;

In LYCOMING County, the city of Williamsport;

In MONTGOMERY County, the townships of Upper Hanover, Skippack, Towamensing, Upper Gwynedd, Lower Gwynedd, Upper Dublin, Springfield, White Marsh, Whitemain, Worcester, Lower Providence, Norriton, Plymouth, Upper Merion and Lower Merion and all boroughs and cities included therein; and also the borough of Lansdale;

In MONTOUR County, the townships of Anthony, Limestone, Valley, West Hemlock, Cooper, Mahoning, Mayberry and the borough of Danville.

In NORTHAMPTON County, the township of Lower Saucon, and the boroughs of South Bethlehem and Hellertown;

In NORTHUMBERLAND County, the townships of Delaware, Lewis, Turbot, West Chillisquaque, East Chillisquaque, Point, Upper Augusta, Gearhart, Rush, Ralpho, Shamokin and Rockefeller, and the boroughs included therein;

The County and City of PHILADELPHIA;

In SNYDER County, all of the county excepting the townships of Monroe, Spring and West Beaver;

In UNION County, all of the county excepting the townships of Lewis and Hartley;

In YORK County, the townships of Codorus and Manheim, and the boroughs included therein.

E. 1. It is prohibited, during the existence of this quarantine, except as hereinafter otherwise provided, to move, drive or transport cattle, sheep, other ruminants and swine, or to ship or remove hay, straw, similar fodder, hides, skins or hoofs from the said quarantined districts.

2. It is forbidden, to drive, transport or move cattle, sheep, other ruminants or swine over or upon public roads or highways within the quarantined districts except upon specific permission in writing from an agent of the State Livestock Sanitary Board expressly authorized to issue such permits.

3. Permits for driving, transporting or moving cattle, sheep, other ruminants or swine over the public roads or highways must be taken

5. Cattle, sheep, other ruminants and swine intended for purposes other than slaughter may be moved from the districts herein quarantined only upon specific permission from the State Veterinarian, and other such restrictions as he may impose in each case.

6. The carcasses of cattle, calves, sheep or goats slaughtered within the quarantined districts, and hides, skins and hoofs removed after January 1, 1909, may be moved to points outside of the quarantined districts without disinfection or certification, provided the said hides, skins or hoofs have not been in contact with hides, skins or hoofs nor with the carcasses of animals slaughtered before January 1, 1909, within the above described quarantined districts.

7. Hides, skins and hoofs of cattle, calves, sheep and goats removed before January 1, 1909, within the described quarantined district shall not be moved to any other part of the State until satisfactorily disinfected and only upon permits from an authorized agent of the State Livestock Sanitary Board; provided, that permits may be issued for transportation to other parts of the State, of undisinfected hides, skins and hoofs from carcasses of animals from outside of the district here quarantined, and that have been removed before January 1, 1909, at an establishment within a quarantined district having inspection under the federal Meat Inspection law if the said hides, skins and hoofs have been stored apart from commodities that it is necessary to disinfect upon certification of the above facts by a federal veterinary inspector.

8. Hay, straw and similar fodder may be removed from the above described quarantined districts to other points in the State upon permit issued by an agent of the State Livestock Sanitary Board.

In closing, I desire to draw your attention to the fact that the clerical work of the office is rapidly increasing and is of much importance as it is our endeavor to answer every letter as rapidly as possible. A day never passes that we do not receive requests from farmers, dairymen, cattle dealers, horse breeders, veterinarians, physicians and others, asking for advice on many phases of veterinary sanitary work. This is one of the channels through which much advice and assistance can be given, thereby facilitating the control of infectious and contagious diseases of animals.

Respectfully submitted,

S. H. GILLILAND,
State Veterinarian.

REPORT OF THE ECONOMIC ZOOLOGIST.

Harrisburg, Pa., January 1, 1910.

Hon. N. B. Critchfield, *Secretary of Agriculture*:

Dear Sir: I take pleasure in submitting the following as the report of the Economic Zoologist, of the Department of Agriculture, for the year 1909:

In Volume I, Number 1, of the Monthly Bulletin of the Division of Zoology, May 1, 1903, we published the following statement: "In accepting the duties of the Economic Zoologist of this State, it is our intention to make the work of this Division as useful and practical as possible, for the class of citizens for whose benefits this office is established." The Bulletin further calls attention to the importance of emphasizing Agricultural Entomology as the chief feature of the Division of Zoology, and said, "We propose to aid you by the following methods:

1. Examining Specimens and Answering Questions sent to Us.
2. Personal work: Investigation and Experimentation.
3. Publication.
4. Lectures.
5. Inspection of Nurseries and Private Premises.
6. Inspection of Imported Plants, Seeds and Fruit.
7. Making Collections."

How well this work has succeeded during the past seven years, must be decided by the citizens of this Commonwealth for whom it has been done; but we can say that we have spared no effort, and lost no opportunity, to render the service outlined; and, from the evidences at hand, in the increased interest in zoology and entomology and related subjects, and the improved orchards, and increasing farm products of this State as well as from hundreds of testimonials at hand, there is proof that results have been achieved which should be counted fairly satisfactory.

We propose, in this report, to take up an account of the features of the work of this office as outlined above, for the year 1909.

1. EXAMINING SPECIMENS AND ANSWERING QUESTIONS SENT TO US.

of voluntary observers developed over this State to a number greater than ever before has been known in any country. Contributions received and numbered in our Accessions Catalog (including those made by our own collectors) during the year numbered 1,777. The printed acknowledgment of these contributions of specimens, from correspondents and voluntary contributors, not including the specimens collected by our own employes, required 31 pages of double columns in the Monthly Bulletins of this Division.

The correspondence has gradually increased, as persons realized that we made an effort to give faithful, personal attention to every letter, and to answer the same as promptly as possible and in such manner as would give practical relief in cases of injury by pests, and also to maintain the professional standing of the office.

The correspondence from this office must necessarily be more extensive than mere business correspondence, for the reason that it is necessary to give minute details, in order to feel certain that the inquirer will be able to obtain satisfactory results, both in pest suppression and in freedom from injury to the plants, by such material as he may apply. Therefore the mere statement of the number of letters written does not give an adequate idea of the volume of the correspondence; but we can report that during the year 6,589 letters were written, copied and mailed from this office. This number does not include those that were mere formal acknowledgments, or of such minor importance as not to justify copying.

It has been our rule at all times to give help on all subjects when requested, but, of course, we have much preferred to confine detailed correspondence chiefly to zoological subjects. Therefore we have often forwarded letters referring to many questions on horticulture, plant diseases, weeds, cultivation, farm crops, etc., to the respective specialists in these lines, especially at our State College and Experiment Station. In doing this we have realized that the work of the Department would be greatly facilitated were it equipped with a Botanist, a Plant Pathologist, and a Horticulturist.

2. INVESTIGATIONS AND EXPERIMENTS.

For the sake of keeping in touch with living Nature, and also to obtain directly, scientific and useful information, and publish the results of our studies as well as those of others, we are maintaining a series of investigations and experiments. These are chiefly along the lines of agricultural zoology and entomology, but are more directly of the nature of biological studies. We found that among the forms of vertebrate life found in Pennsylvania, those generally known as reptiles, or the cold-blooded land vertebrates, has been greatly neglected by persons who might have done something to obtain the facts concerning these creatures and remove the clouds of ignorance and superstition surrounding them. After having carefully studied the serpents of Pennsylvania, especially in regard to their food and habits, and having published upon the same in Volume IV, of the Monthly Bulletin of the Division of Zoology, we next made a careful economic and biologic study of the lizards of this Commonwealth, upon which we published in Volume V, No. 8, December, 1907; and we next turned our attention to the turtles, upon which we published

in a completely illustrated Bulletin as Volume VI, Nos. 4 and 5, in September, 1908; thus completing the preliminary studies and publications of the true reptiles of Pennsylvania.

Naturally, the next in line to receive our attention were the amphibians, including the frogs, toads and salamanders. During the year 1909 we made a careful study of these creatures, collecting specimens, studying stomach contents, etc., in order to obtain facts concerning their feeding habits, and making notes upon their relative abundance, haunts and places of occurrence of the various species found in this Commonwealth. The facts obtained have been arranged for publication in a Bulletin, which we hope to issue during the coming summer. The chief features brought forth are the facts that none of our amphibians (frogs, toads and salamanders) are venomous, none poisonous, and none are obnoxious from an economic standpoint; while all are beneficial in feeding upon insects of various kinds, most of which are of injurious species.

Various investigations of the minor features of zoological and entomological subjects have been made in this office, and results have been announced from time to time in the Monthly bulletins, and inquiries have always been given the immediate benefits of such facts in direct correspondence.

We have been forced again and again to recognize the fact that insecticidal treatment, such as spraying, is not alone sufficient to make good trees or produce good fruit. The entire art of horticulture is necessary, as surely as hygienic measures of all kinds must go hand in hand with the curative prescriptions of a physician. For example, we have seen trees of the same size, age, and variety, treated in exactly the same manner, sprayed with the lime-sulfur wash, at the same time, for San José scale, and the pest destroyed on both; but upon one; which was cut back at the time of spraying (while yet dormant), an excellent crop of fruit was produced the second summer afterwards, while the other which was not topped or cut back, produced no fruit whatever. Thus pruning is proven to be an accompaniment of spraying, in order to obtain proper results. Likewise the stimulating of trees by feeding or fertilizing, by cultivating, by thinning of fruit, and by every other horticultural means, is an important undertaking if the best results are desired.

The stimulation of trees, whether drooping through pest attacks, or through failure to start well when transplanted, is very important to the planter of a young orchard, or to the owner of declining trees. To ascertain the effects of plant stimulants we tried experiments, as follows:

EFFECTS OF PLANT STIMULANT.

Three stimulants were used, the first being nux vomica, the second strychnine, and the third nitrate of soda. On June 9th, nux vomica was used in the proportion of one drachm to a quart of water, poured around the roots of several feeble trees. They were young trees which were refusing to start well. All of the trees were watered regularly during this treatment. On June 13th, one tree put forth leaf buds, and on June 17th, young leaves appeared. Other trees treated did not show any signs of life, and the results were "bad." The material was tried on the other trees with no good effect whatever.

Strychnine used at one-fourth ounce in fifty gallons of water, was applied on June 24th, three quarts being given to each young tree. The trees were in the same condition as those treated with the previously-named material. There were no beneficial results whatever.

Nitrate of soda was used in the proportion of one quart of this material to fifty gallons of water, and was applied to partly dead, and apparently dying trees, on June 9th. On June 13th, the trees showed that they were reviving considerably, and upon examination at the later date, the results were found to be generally fine. Of the three plant stimulants,—*nux vomica*, strychnine, and nitrate of soda,—the latter alone gave appreciable beneficial results.

Based upon this and similar experiments, we have generally recommended that when a tree is declining, it be treated with nitrate of soda, either scattered broadcast over the ground, using one or two pounds to the tree, and then watering; or that it be treated with about a quart of this material dissolved in a barrel of water, and the soil thoroughly soaked and afterward mulched. We had many reports from practical tree growers in this State, especially along village streets, who have renewed the life of a tree by this method.

POTATO EXPERIMENTS FOR SCAB.

In experimenting for potato scab we treated seed potatoes by soaking them in each of the following substances: Corrosive sublimate, mercuric bichloride, two ounces in fifteen gallons of water; formalin or formaldehyde, one pint in fifteen gallons of water, and the lime-sulfur wash made at San José scale strength, and used with three gallons of the solution in nine gallons of water. The experiments showed the mercuric bichloride and the formalin both to be efficient in destroying the scab germs, and in preventing scab, while the results where the lime-sulfur solution was used, were not satisfactory.

EXPERIMENTS WITH PEACH-TREE BORERS.

In one series of experiments we painted the trunks of two-year-old peach trees for borers. Some trees were left untreated as checks for comparison with those that were painted. Twenty per cent. of the untreated trees of the check plot were found to be infested; only ten per cent. painted with white lead and linseed oil were infested, and seventeen per cent. of those painted with whale oil soap were infested, while eighteen per cent. of those painted with lime-sulfur were infested. The comparatively high per cent. of infested trees after painting was no doubt due to the fact that this painting was done too late in the year to be really preventive, as it was done in September, after the pests had entered the trees.

Another series of experiments performed earlier in the summer showed conclusively, that painting or spraying the trunk of the tree with lime-sulfur wash, or an application of sulfur compound, at the base of the tree, if done before the eggs are laid or hatch, in the latter part of June, will be sufficient to protect the tree very effectively against the later attacks of borers. We found this to be cheaper than any material, and also more efficient, and absolutely safe upon the trees.

We further found that in applying commercial oils as sprays to the base of the trunk of a tree, decidedly evil effects were liable to result. In fact, several fine trees were killed by the application of "San-U-Zay Scale Oil," one part dilute with fifteen of water; and a whole row of trees was killed by the application of the "Vacuum Spray Oil," dilute in the same proportion.

Wood ashes put around the trees were not found to be quite satisfactory in preventing the attacks of borers, unless a little powdered sulfur was mixed with the ashes, near the trunks of the trees, in which case the results were very good.

EXPERIMENTS WITH CROWN GALL ON RASPBERRY.

Thirty raspberry plants purchased from the nursery, were infected with crown gall, and were treated by dipping the roots of some of them into lime-sulfur solution, at San José strength, leaving the galls on the roots; and by cutting the galls from others, and then dipping them. All were then planted, and watered during the dry weather following planting. The plants were all found to be dead one month from the date of planting. This indicates that dipping of the roots of trees or plants in the lime-sulfur solution is not desirable, as we believe the caustic solution had much to do with the death of the plants.

EXPERIMENTS FOR ROSE MILDEW.

On June 4th, rose bushes were sprayed with four ounces of sodium sulphite in each gallon of water. The bushes were in very bad condition with mildew. Within two days the leaves were observed to be somewhat clearer, and within a month the bushes were putting forth new shoots, and were cleaned of the disease. In other experiments we found that sulfur in plain form, or in any of its compounds, will act as a decided preventive for mildew. We are now recommending one ounce of sulphite of soda, or one ounce of sulfide of potassium, or one handful of free flowers of sulfur, in each gallon of water, applied as a spray, or flowers of sulfur dusted over the plants while the leaves are wet with dew. This work should be done upon the very first appearance of mildew.

3. PUBLICATIONS.

The publications of this office have been as follows:

(a) The Monthly Bulletin: The Monthly Bulletin of the Division of Zoology was issued as regularly throughout the year as conditions would permit. Owing to special demands upon our time, or upon the public printer, it could not always be issued on the first day of the month for which it was intended, but it found its place, and met with such favor that there has been a constant call for the addition of more names to our mailing list. Forty-four thousand copies of this Bulletin are issued and distributed each month. The mere task of preparing and mailing this Bulletin, continuing through seven years, and seven complete volumes, has been tremendous, and

such that it appears that it will be best to change it to a quarterly issue. Therefore, we contemplate a revision of the mailing list, and changing the publication to a Quarterly Bulletin next summer.

Our little Bulletin has been written in more or less popular style, but it is evident that it has exactly met the needs of the people, and that it has rendered a very important service. The statements and directions which it contains have been watched with care by scientific men as well as extensive practical growers. We have had calls for it from almost every state in the Union, and also from many foreign countries. Prominent professional men, horticulturists, entomologists and directors of State Inspection work elsewhere have written for copies to be placed in the hands of their employees.

Concerning this subject, I wish to add that, considering the fact that these Bulletins have been continued for almost seven years, at the rate of more than one page for each day of the month, it is remarkable that they have continued to grow in public favor. This is chiefly due to the fact that we have tried to keep the material contained therein practical, readable and reliable, discussing, as far as possible, the more important timely topics. To do this and avoid repetition in seven successive volumes has required special care and thought, and was made possible only through much study and practical experience by the writer.

(b) The Weekly Press Letter: Beginning in April of this year we undertook to issue a Weekly Press Letter, which has, by all means, been the most successful undertaking yet seen in the way of a publication. The Press Letter has been prepared chiefly by the aid of Mr. Cyrus T. Fox, of Reading, from the correspondence of the Economic Zoologist. Mr. Fox is an editor by nature, and was able to take the most important letters received by us, and copies of our replies, and weave them together into a practical, strictly timely, readable series of articles. Generally, about three articles have been used in each Press Letter, each of these being about one-third of a column in length, discussing some strictly timely topic of pest suppression in a condensed and rational manner. These letters were printed on one side of a sheet of paper in proof form, and sent to the newspapers of the State of Pennsylvania, and to the horticultural and agricultural journals and publications in America in general.

Over three-fourths of our newspapers are now using these Weekly Press Letters, many of them making a special feature of using them in full each week. The results in helpfulness to the public have more than exceeded our expectations.

The printed letter is mailed to the newspapers on Monday of each week, and contains chiefly articles that should be published as widely as possible during the particular week of issue. Many correspondents have informed us that the information was just such as they were seeking, and given at a time when it saved them property which would otherwise have been destroyed with a loss of hundreds of dollars. This important service has been given to the citizens of Pennsylvania at an expense of about fifty-seven cents per week for printing, and about eight cents per week for postage, as we were able to secure pound rates, by virtue of this letter being a periodical, it was duly entered as second-class mail matter at the U. S. Post Office Department at Washington, D. C.

Another important feature of the Press Letter, is the extensive dissemination of information which it contains, by being republished in the progressive newspapers, and through securing their co-operation, in multiplying the usefulness of this office many fold.

(c) Newspapers: Special articles have been written for newspapers upon pests that were of particular importance in any locality, and the editors of this State have now come to look upon the information disseminated from this office as reliable and important. They are almost universally falling into the custom of sending inquiries directly to us for replies that they can publish. It is not uncommon for some editor at a distance from Harrisburg, to call up this office by long distance telephone, and request information on the sudden outbreak of insect pests or plant diseases, asking for directions which can be published for immediate remedies or preventives. The saving to the practical citizens of our State by that kind of intelligent co-operation certainly amounts to tens of thousands of dollars.

4. LECTURES AND ADDRESSES.

Representatives of this office are frequently called upon to render public service in the form of addresses or lectures at public meetings. During the year each of our Orchard Inspectors spoke several times at public meetings, and the Economic Zoologist appeared on thirty-five programs in different parts of the State; besides several weeks of special service on the Demonstration and Lecture Train. It is fortunate that our inspectors are men who can give public demonstrations and talk intelligently to audiences needing their aid.

5. INSPECTION.

The inspection work has consisted of two chief features, namely, the inspection of nurseries and the inspection of private premises or orchards. These went hand in hand, for the purpose of detecting and eliminating the pests on nursery stock that was sent out over this State, and also for cleaning up the more serious pests which had already found their way to private premises. It would do no good to go to the trouble and expense of inspecting and fumigating nursery stock to be sure that it is free from very injurious pests, if it is to be planted on premises that are already infested with the same kind of pests, and neglected until it becomes infested.

On the other hand, it would be useless to inspect and clean up the home premises if nursery stock coming into the same were liable to bring serious pests, either of an old and recognized injurious species, or of a new kind. These two features of inspection are plainly necessary and concomitant.

(a) THE INSPECTION OF NURSERIES.

During the past year the inspection of nurseries has been pushed with more than usual vigor, during both the summer season and the winter. This is the third year that we have inspected nurseries during the winter time, and the results are found to be so beneficial that it is determined to continue this feature of the inspection. The summer inspection is started the first of August and is continued until all the nurseries of the State are thoroughly inspected, which

is generally until about the middle of September. However careful and conscientious the inspector may be at the time of inspection, it is impossible to find all the scale insects that may be concealed beneath green leaves and buds during the summer inspection, and also there is great danger that the scale may spread after this inspection is finished and infest nursery stock which was clean at the time it was inspected.

In order to be certain to find the San José scale and other tree pests the February inspection is made when the trees are not in leaf, and there is a better opportunity to inspect them thoroughly and see that they are in proper condition for spring sales. The inspections have been made with greater care than ever before, and the nurserymen themselves have commended it and commented upon the thoroughness with which the present force of inspectors are doing their work. The results are gratifying to all parties concerned.

When the nursery inspection was first undertaken, some of the nurserymen were opposed to it for the reason that they thought it was interfering with their rights and property, and that they should be permitted to sell the nursery stock grown on their own land if the infestation came by means for which they were not responsible. They now fully understand that to stay in the business permanently and continue to make sales they must of necessity sell good stock in good condition, and satisfy customers. Thus they have become enthusiastic supporters of a very rigid system of nursery inspection.

The greatest evil threatening nursery stock in this State has been infested trees or shrubbery in the vicinity of nurseries, and the great danger of the San José scale spreading readily from such trees to the nursery stock. Several cases of nursery infestation by such means were found by our inspectors a few years ago, and this justified the movement on our part to force the owners to rid their trees of such dangerous pests. As a consequence, last summer we gave considerable attention to inspecting trees and shrubs in the vicinity of nurseries but not on the same premises, and notified the owners that their property must be treated by certain means or it would be our duty to treat it or destroy it in order to get rid of the scale threatening the nursery stock and trees of neighbors. We are much gratified to report that in every case prompt remedial action was taken by the owners, and the results are very gratifying to all parties concerned. Nurserymen report that they have had during the past season far less infestation from scale from surrounding premises than ever before, and we believe that by this method we can reduce the San José scale reaching nursery stock and consequently extending into the orchards of this State.

Our requirements where trees are found infested in a nursery are to destroy all trees that can be found attacked by San José scale, and fumigate all others from that nursery before they are sold or shipped. There has been considerable complaint made against fumigation, some persons claiming that it injured their trees, but we know of a series of fumigation experiments which show that three times the required dosage of one ounce of the cyanide of potassium to one hundred cubic feet of space resulted in no injury whatever to the trees or cuttings. It is by all means best to have nursery stock fumigated at the nursery before shipping,

whether it be infested or not. The reports adverse to fumigation have mostly come from persons who wished to be excused from the trouble of insuring, by this method, the freedom of their trees from pests.

It is against the law to ship any nursery stock, of varieties liable to be attacked by the San José scale, into this State from any other state or country without certificates both of inspection and fumigation being attached to each package, bale or bundle in the shipment. Persons who have opportunity are invited to aid us in the prosecution of the law by watching for incoming packages at railroad stations, express offices, etc., which may not bear tags certifying both inspection and fumigation, as required by our State law. Reports of such infringement should be sent at once to the Secretary of Agriculture with details of the facts of the case, with the name of the shipper as well as the consignee, and the railroad or express company carrying the shipment.

It is likewise illegal to sell, ship or transport any nursery stock, for any distance whatever in this State, without said stock having attached thereto a certificate of inspection, showing when and by whom it was inspected, and if it has been fumigated, a certificate or statement of fumigation must likewise be attached. Purchasers are advised to reject all shipments not tagged or labeled in accordance with these statements, and notify this office of observed infringements of the law.

The work of the inspection has been greatly increased this year by the necessity of carefully inspecting all stock imported into this State from foreign countries, for the purpose of detecting the Brown-tail moth, the Gypsy moth and other serious pests not at present known in this Commonwealth. This inspection was mostly done during the latter part of the winter, and the very early part of the spring, as it had to be done immediately upon the arrival of the imported stock. It was done at the nurseries or premises where the cases were opened. About twelve hundred large cases of stock were inspected, containing a total of nearly two million plants. Nearly one hundred nests of the destructive Brown-tail moth were found and destroyed, and it is believed that none escaped. The Gypsy moth was not found on any of the imported stock.

Although the work of inspection was done through the office of the Economic Zoologist, Mr. E. B. Engle, as Chief Nursery Inspector, has been responsible for most of the details of the inspection work, and has spent most of his time in the field. His services have continued

LIST OF NURSERIES IN PENNSYLVANIA.

ADAMS COUNTY.

Name.	Place.	Acres.	Certificate number.
E. P. Garretson,	Biglerville,	4	1481
H. G. Baugher,	Aspers,	3	1460
C. A. Stoner,	Gettysburg,	2	1389
Charles J. Wilson, R. F. D.,	Gettysburg,	2	1461
H. R. Plank,	York Springs,	2	1515
Oyler & Hartman, R. D. No. 5,	Gettysburg,	2	1388
Cornelius Bender, R. D. No. 2,	Aspers,	3	1387

ALLEGHENY COUNTY.

Elliott Nursery Co.,	Springdale,	30	1462
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BEAVER COUNTY.

James W. Mackall,	Beaver,	15	1370
R. O. Mackall,	Beaver,	10	1368
J. Hoyt,	Industry,	10	1371
A. P. Goodwin,	Industry,	6	1367
A. J. Freed,*	Racine,	2	1439
W. A. Freed,*	Racine,	4	1440
Joseph and Charles Engle, R. D. No. 2,*	Beaver,	6	1369
Arnold Bros., R. D. No. 1,*	Beaver Falls,	5	1438
Enoch Engle, R. D. No. 1,*	Beaver,	84	1366

BEDFORD COUNTY.

Austin Wright,	Alum Bank,	3	1523
Penna. Department of Forestry, W. L. Byers, Forester,	Rainsburg,	4	1392

BERKS COUNTY.

Wenrich Bros.,	Robesonia,	3	1296
Bertrand H. Farr,	Wyomissing,	10	1506

BRADFORD COUNTY.

Samuel H. Madden, U. S. Weather Bureau, Colum-	... County	3	1497
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BUCKS COUNTY.

Name.	Place.	Acre.	Certificate number.
J. L. Lovett,	Emmelle,	8	1479
Henry Palmer,	Langhorne,	3	1492
Horace Janney,	Newtown,	5	1465
D. Landreth Seed Co.,	Bristol,	3	1466
The W. H. Moon Co.,	Morrisville,	200	1452
Samuel C. Moon,	Morrisville,	50	1451
D. J. Younken,	Richlandtown,	1	1501
Jacob F. Krout, R. D. No. 1,	Perkasie,	2	1499
Penna. R. R. Co., Forestry Department, Philadelphia, Pa. Nursery near,	Morrisville,	20	1457

CHESTER COUNTY.

James Donoghue,	Kennett Square,	2	1493
W. H. Doyle,	Berwyn,	5	1418
The Morris Nursery Co.,	West Chester,	800	1459
The Conrad & Jones Co.,	West Grove,	30	1422
The Dingee & Conard Co.,	West Grove,	15	1496
The Rakestraw Pyle Co.,	Kennett Square,	200	1463
J. A. Roberts,	Malvern,	6	1456
Hoopes Bro. & Thomas Co.,	West Chester,	600	1411
J. B. Reif,	Spring City,	2	1490
E. B. Keating,	Kennett Square,	8	1414
Louis B. Eastburn,	Kennett Square,	3	1419

CLEARFIELD COUNTY.

W. S. Wright,	Clearfield,	1	1521
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COLUMBIA COUNTY.

Philip Harris, R. F. D.,	Light Street,	1	1394
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CRAWFORD COUNTY.

David Kelty,*	Cochranon,	1½	1877
M. N. Shepard,*	Cochranon,	1	1879
Anderson Bailey, R. D. No. 66,*	Cochranon,	13	1881
Henry Roberts, R. D. No. 66*	Cochranon,	6	1882
J. T. Reed, R. D. No. 66,	Cochranon,	2	1880
Samuel J. Cooper, R. D. No. 58,	Cochranon,	4½	1878
Lewis E. Swogger, R. D. No. 28,*	Carlton,	2½	1882
The Penna. Nursery Co., office at Girard, Pa..	Shermansville,	25	1876
J. Q. Marsh,	Geneva,	6½	1442
L. L. Wood,*	Geneva,	3½	1443
Peter Schander, R. D. No. 2,*	Meadville,	3	1429
Henry Shellito, R. D. No. 41,	Linesville,	1	1404

*Grow berry or small fruit plants only.

CUMBERLAND COUNTY.

Name.	Place.	Acres.	Certificate number.
J. T. Opperman,*	Camp Hill,	1	1528
B. F. Cocklin, R. D. No. 2,	Mechanicsburg,	4	1539

DAUPHIN COUNTY.

The Berryhill Nursery,	Harrisburg,	2	1523
C. P. Scholl, R. D. No. 1,	Halifax,	5	1514
Andrew Coble, R. D. No. 1,	Middletown,	6	1497
Adolph Thomann,	Harrisburg,	1	1519

DELAWARE COUNTY.

P. Z. Supplee,	Oollingdale,	25	1413
J. J. Styer,	Concordville,	2	1470
M. J. Porter,	Wayne,	5	1498
O. H. Pettiford,	Lansdowne,	1	1524
W. E. Caum (Lessee),	Haverford,	12	1520
John G. Gardner,	Bryn Mawr,	10	1470
H. H. Battles,	Newtown Square,	10	1471
Otto Lochman & Co.,	Wallingford,	1	1504

ERIE COUNTY.

Miss F. C. Day,*	Girard,	9	1407
L. C. Hall,	Avonia,	2	1408
H. C. Pettis,	Platea,	4	1445
Dr. A. B. Heard,	North East,	4	1526
A. F. Youngs,*	North East,	5	1446
Orton Bros.,	North East,	2 ¹	1434
L. G. Youngs,	North East,	4	1401
D. C. Bostwick & Son,*	Ripley, N. Y.,	5	1436
M. E. Kelly, R. D. No. 2,*	North East,	4	1437
A. J. Youngs,*	North East,	1 ¹	1400
W. E. Smith, R. D. No. 3,*	North East,	8 ¹	1455
J. G. Bagley,*	North East,	1	1483

FRANKLIN COUNTY.

LACKAWANNA COUNTY.

Name.	Place.	Acres.	Certificate number.
Elmer E. Richards,*	Baldmount,	1	1475
John W. Shepherd, 945 Clay Ave.,	Scranton,	4	1464
Daniel O'Hora,	Dunmore,	4	1506

LANCASTER COUNTY.

John G. Engle,	Marietta,	2	1518
Maurice J. Brinton,	Christiana,	20	1564
W. P. Bolton, R. F. D.,	McCall's Ferry,	2	1586
D. D. Herr,	Lancaster,	10	1585
Wilson Kready,	Mt. Joy,	1	1467
O. W. Lauhey,	Bird-in-hand,	2	1439
A. W. Root & Bro., R. D. No. 1,	Manheim,	20	1498
David S. Herr, R. D. No. 7,	Lancaster,	10	1365
M. H. Musser,	Lancaster,	5	1390
B. F. Barr & Co.,	Lancaster,	3	1512
Frank A. Suter,	Lancaster,	1	1361
Mayer & Son,	Willow Street,	2	1360

LAWRENCE COUNTY.

Butz Bros.,	New Castle,	1	1405
A. S. Moore,	New Castle,	1	1406
D. W. Fisher,	New Wilmington,	1	1441

LEHIGH COUNTY.

W. B. K. Johnson Estate,	Allentown,	20	1513
Preston J. Kline,	Coopersburg,	3	1478

LUZERNE COUNTY.

Miss M. A. Maffett,	Wilkes-Barre,	1	1480
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MERCER COUNTY.

H. H. McClean,*	Stoneboro,	3	1373
D. C. McClearn,*	Stoneboro,	2	1373
Geo. W. Proud,*	Stoneboro,	2	1374
James McClearn,*	Stoneboro,	1	1375
O. P. McLean,*	Greenville,	1	1383
W. M. Doyle,*	Stoneboro,	10	1431
Robert Doyle,*	Stoneboro,	5	1444
J. W. Nelson,*	Volant,	2	1527
George E. Brocklehurst, R. D. No. 20,*	Jackson Centre,	4	1430
J. T. McLean, R. D. No. 46,*	Greenville,	3	1384
J. L. Hoobler & Sons, R. D. No. 34,*	Hadley,	3	1408
W. R. Orlbbs,*	Merger,	3	1409
H. W. Allison, R. D. No. 9,*	Merger,	7	1428

*Grow berry or small fruit plants only.

MIFFLIN COUNTY.

Name.	Place.	Acres.	Certificate number.
Penna. Department of Forestry, W. H. Kraft, Forester, Nursery and forest reservation near Greenwood, Huntingdon Co., Pa.,	Belleville,	3½	1391

MONTGOMERY COUNTY.

Chris Koehler,	Cheltenham,	2	1508
R. B. Haines Co.,	Cheltenham,	4	1450
J. B. Heckler,	Lansdale,	4	1481
J. W. Thomas & Sons,	King of Prussia,	75	1507
Benjamin Reig,	Jenkintown,	8	1500
J. Krewson & Sons,	Cheltenham,	20	1449
T. N. Yates & Co.,	North Wales,	100	1458
J. B. Moore,	Hatfield,	5	1448
Adolph Mueller,	Norristown,	5	1417
Thomas Meehan & Sons, Inc.,	Dresher,	216	1453
Wm. Sturzbecher,	Lansdale,	1	1424
Edward D. Drown,	Weldon,	4	1397
J. G. Steffin,	Norristown,	2½	1425
Somerton Nurseries, A. U. Barnard, Mgr., 125 S. 6th St., Philadelphia,	Somerton,	15	1412

MONBOE COUNTY.

E. M. Werkeiser,	Stroudsburg,	2	1510
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NORTHAMPTON COUNTY.

Theodore Roth,	Nazareth,	1	1460
Hays Nursery Co.,	Easton,	1	1525

NORTHUMBERLAND COUNTY.

Francis W. Peifer, R. F. D., *	Fishers Ferry,	2	1484
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PERRY COUNTY.

Geo. A. Wagner, R. F. D.,	Landisburg,	4	1516
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PHILADELPHIA COUNTY.

Chas. A. Knapp, 7634 Carson St.,	Chestnut Hill,	1	1420
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ANNUAL REPORT OF THE

Off. Doc.

SNYDER COUNTY.

Name.	Place.	Acres.	Certificate number.
John F. Boyer, R. D.,*	Middleburg,	6	1488
Philip A. Apple, R. F. D.,*	Middleburg,	3	1485
Fred G. Moyer,*	Freeburg,	2	1491
W. J. Koch, R. F. D.,	McClure,	1	1493

SOMERSET COUNTY.

M. L. Lancaster,	Harnedsville,	4	1350
H. E. Purbrough,	Harnedsville,	3	1363

SUSQUEHANNA COUNTY.

E. A. Smith,*	Heart Lake,	7	1477
Geo. P. Sprout, R. D. No. 66,*	Montrose,	6	1478

TIOGA COUNTY.

Arthur Edwards,	Elkland,	4	1468
Homer B. Howe,*	Wellsboro,	3	1502
E. F. Callahan,	Wellsboro,	1	1503
Penna. Department of Forestry, Paul H. Mulford,			
Forester,	Asaph,	8	1511

UNION COUNTY.

C. K. Sober (nursery near Paxinos, Northumberland county),	Lewisburg,	5	1395
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VENANGO COUNTY.

Venango Nursery Co., R. F. D. No. 1,	Franklin,	5	1403
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WESTMORELAND COUNTY.

John McAdams,	Mt. Pleasant,	1	1362
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WYOMING COUNTY.

F. H. Fassett,*	Meshoppen,	1	1474
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LICENSED TREE DEALERS.

ALLEGHENY COUNTY.

	Number of Certificate.
H. M. Devereaux, 900 Arch St., Allegheny,	327
W. B. Bockstose, Castle Shannon,	353
L. F. Miller, 1023 Garret St., Pittsburg,	316
E. C. Hauser, Bellevue,	333
John W. Howard, 7159 Mt. Vernon St., Pittsburg,	416
Joseph Jones, 102 Diamond Market, Pittsburg,	401
Kauffman Bros., Pittsburg,	394
John Bader, Pittsburg, N. S.,	395
Joseph Horne Co., Pittsburg,	396
Mark E. Head, Bellevue,	361
Chas. Honess & Son, Allegheny,	388
J. F. Zimmerman, 6624 Penn Ave., Pittsburg,	340
J. M. Falls, 1807 Runette Ave., Pittsburg,	348
Max Mueller & Co., Coraopolis,	413

BEAVER COUNTY.

J. C. Withrow, Vanport,	346
J. H. Gutermuth, Rochester,	352
A. E. Grouch, Rochester,	347

BEDFORD COUNTY.

Elijah Collins, Clearfield,	338
A. J. Schwoyer, Hyndman,	380

BERKS COUNTY.

Jacob H. Weandt, Reading,	389
M. E. Smeltzer, Reading,	386
Alfred Dreibeibis, Reading,	367
Wm. P. Ruth, Wernersville,	371
L. M. Neischwender, Hamburg,	405

BLAIR COUNTY.

James Hopkins,	315
E. F. Giles, Altoona,	414

BRADFORD COUNTY.

J. F. Gable, Athens,	391
Jos. D. Hamilton, R. D. No. 16, Rome,	326

BUCKS COUNTY.

John F. Barclay, Dyerstown,	417
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BUTLER COUNTY.

Geo. W. Haine, R. D. No. 32, Callery,	317
Wm. C. Riddle, Slippery Rock,	410

CARBON COUNTY.

Paul Neihoff, Lehighton,	336
David N. Rehr, Lehighton,	376

ANNUAL REPORT OF THE
CHESTER COUNTY.

Off. Doc.

	Number of Certificate.
John Alcorn, Malvern,	313
Benjamin Connell, West Grove,	373

CLEARFIELD COUNTY.

Thos. W. Munro, DuBois,	398
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CLINTON COUNTY.

W. W. Richie, Lock Haven,	375
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CRAWFORD COUNTY.

J. C. Boyd, Guy's Mills,	325
F. M. Fleming, Cochranton,	383
A. B. Greenfield & Son, Conneautville,	335

CUMBERLAND COUNTY.

Ira A. Bigler, Camp Hill,	341
D. C. Rupp, Shiremanstown,	331
Towser & Wolff, Carlisle,	319

DAUPHIN COUNTY.

A. H. Shreiner, Harrisburg,	314
Geo. F. Greenawalt, Hummelstown,	339
T. A. Woods, Harrisburg,	404
J. R. Snavely, Harrisburg,	364
J. M. Christman, Fort Hunter,	356

DELAWARE COUNTY.

John Wetherhill, Chester,	379
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ERIE COUNTY.

C. E. Powell, Lundy's Lane,	373
E. S. Powell, Lundy's Lane,	322
H. C. Pettis, Platea,	359
Wm. Keefe, Erie,	418
C. J. Roberts, Albion,	419

FRANKLIN COUNTY.

J. W. Heffelfinger, Greenvillage,	320
H. C. Ely, Waynesboro,	351
W. E. Nisewonder, Mason & Dixon,	408

FULTON COUNTY.

J. M. Sipe, Harrisonville,	350
S. M. Robinson, McConnellsburg,	397

LACKAWANNA COUNTY.

Giles L. Clark, Scranton,	332
A. J. Noble, Scranton,	345
Geo. R. Clark, Scranton,	399

LEBANON COUNTY.

	Number of Certificate.
Samuel P. Moyer, Myerstown,	342
M. D. M. Batdorff, Richland,	393

LANCASTER COUNTY.

Amos D. Herr, Lancaster,	357
Daniel G. Engle, Marietta,	402

LEHIGH COUNTY.

N. C. Beachy, Allentown,	354
Melchoir Werkheiser, Allentown,	400
Samuel I. Leh, Allentown,	406

LUZERNE COUNTY.

B. H. Kilmer, Wilkes-Barre,	343
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LYCOMING COUNTY.

Evenden Bros., Williamsport,	374
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McKEAN COUNTY.

F. S. Palmer, Bradford,	365
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MONROE COUNTY.

L. D. Eisenberger, E. Stroudsburg,	323
S. P. Smiley, Stroudsburg,	324

(b) THE INSPECTION OF PRIVATE PREMISES.

No extensive move by this office has been met with more universal approval than our inspection of private premises, for the sake of detecting pests and instructing the owners how to destroy them. Competent inspectors were appointed in different parts of the State, and each was assigned to a district consisting of from one to three counties. These men were called together by the Economic Zoologist and given a series of lectures, as well as practical instruction in orchards, especially to qualify them for the particular duties of orchard inspection. Twice throughout the year we had a "General Round-up Meeting," for the purpose of further instruction and study. These meetings were a source of inspiration to the inspectors, and, of course, resulted in much good to the Commonwealth through better qualifying these men to render expert service which was needed, and for which they could become qualified only by such means.

The inspectors are sent to their respective districts equipped with microscopes and report blanks. The orchard, and all trees, shrubs and vines on the premises are inspected; the inspector makes out a detailed report, giving the number, age and kind of trees inspected, the kind of pest to be found upon each respectively, and if several different kinds of pests are found, listing each. A copy of this report

is left with the owner, and another copy is sent directly to this office. A form of the Report Blank now in use is given below:

REPORT OF ORCHARD INSPECTOR.

'TO BE FILLED FOR EACH PLACE INSPECTED.'

Sircular 8.

Date:

Time of day:

Dear Sir: I have today inspected your trees and shrubs at (P. O.)

(W.P.,.....Co.,.....)

.....and it is my duty to report as follows:

Name of Tenant.....Address.....

Name of Owner.....

Name of Tenant.....

Name of Owner.....

	Distance and direction from Post Office.			
	San J.	Scurfy.	Oyster S.	Lecan.
No. Apple Trees.	{ Young,.....	Insects found.		
	{ Bearing,.....	Insects found.		
No. Pear Trees.	{ Young,.....	Insects found.		
	{ Bearing,.....	Insects found.		
No. Peach Trees.	{ Young,.....	Insects found.		
	{ Bearing,.....	Insects found.		
No. Plum Trees.	{ Young,.....	Insects found.		
	{ Bearing,.....	Insects found.		
No. Cherry Trees.	{ Young,.....	Insects found.		
	{ Bearing,.....	Insects found.		

[Infested Shrubbery.....

Has this Orchard been treated for San Jose Scale?.....

With what Material?

Marks: + = infested slightly; ++ = considerably infested; + + + = badly infested; — = not found.

For further information address Prof. H. A. SURFACE, State Zoologist, Harrisburg, Pa.
My Address:.....

.....Authorized Inspector.

pests which the inspector has found injuring his plants. As a rule, these directions are followed by the owner at the proper time. It is very evident that nearly all persons are interested, and that this work is now resulting in saving an immense amount of property which otherwise would have gone as useless toll for the bugs.

The public can see that we are in earnest in this work, and that our scientific reputation is at stake in every recommendation that we give. Fortunately, they have sufficient faith to try to follow directions, and when this is done, with any fair degree of accuracy, it almost always results in success in controlling the pests. This saving of crops otherwise regarded as doomed, has arrested the attention of the public, and has spread the usefulness of this work to a remarkable degree. A few specific instances of this kind may well be mentioned:

M. C. C. Gelwicks, of Saint Thomas, Franklin county, was pulling his apple trees with a traction engine, because they were infested with San Jose Scale, and he was discouraged. The fruit was so badly marked as to be unsalable. We learned that he was destroying his orchard, and sent Dr. J. H. Funk to give a demonstration of the methods of spraying with the lime-sulfur wash for San José Scale. Mr. Gelwicks followed carefully the directions given at the public demonstration meeting, and the very next year produced a crop of apples so free from scale that he offered to pay any man five dollars for any scale-marked apple to be found in the orchard. Last year the crop from this same orchard was phenomenal in quality, quantity and perfection. We understand that it was sold to a dealer for five thousand dollars, in the orchard. This is very encouraging as showing the possibilities of thirty acres of Pennsylvania land, several miles from a railroad.

Mr. Howard Shafer, Stroudsburg, Monroe county, found his peach trees badly infested with San José scale, and under our instructions topped them back, cultivated and fertilized them, after having washed the stubs with boiled lime-sulfur wash. This last summer he sold from his six acres of about one thousand peach trees, five thousand dollars worth of fruit. Mr. J. A. Brandt, of Newville, Cumberland county, had a similar experience.

Perhaps the most remarkable case of successful apple production in this State, was that of Lewis Bros., of Pittston. A small corner of their orchard was set aside for demonstration purposes by this office. We pruned and sprayed a few trees in the presence of assembled spectators. Lewis Brothers did their own orchard work, in a manner unparalleled in this State for intelligence, skill and effort. They showed apples at the recent meeting of the State Horticultural Society, far surpassing in beauty, attractiveness and quality the fruits elsewhere produced. They were equal to those produced, boxed and shipped from the Bitter Root region of Montana. It was one of the finest exhibitions of apples, actually grown upon one farm ever produced in the State of Pennsylvania.

Col. Fred Reynolds, of Bellefonte, had a peach orchard nearly mature in which the San José scale was starting. Our first public demonstration for the direct education of the inspectors was given in this orchard. The scale was immediately suppressed, and last summer from the same orchard, Col. Reynolds sold about forty thousand dollars worth of fruit.

Numerous other specific cases could be cited concerning the success of persons who made use of the directions and co-operation of this office in suppressing pests and producing good crops. However, the reports of the inspectors should be given by themselves, and we, therefore, publish them just as they were written by the men who have been through the orchards. These are as follows:

REPORTS BY COUNTIES.

ADAMS COUNTY.

Inspector, J. D. HERR, *Lancaster, Pa.*

Mr. Herr's counties: Adams, Berks and Lower Lancaster.

There is as yet no co-operation in my territory worthy the name. Berks county has an Agricultural and Horticultural Society, which meets once a month. Adams county has a live Horticultural Society, but with the exception of a few transactions of a quasi-co-operative nature, nothing in this line has been attempted. The reasons, I think, are lack of interest and of confidence.

Much good has already been accomplished by the active campaign carried on by the Division of Zoology during the last four years. Property representing millions of dollars has been saved to the citizens of this State. I believe, however, a greater good, more far-reaching in its results, has accrued to the rural people of the Commonwealth by the quickening of their minds, which have been opened to the laws and principles which govern their physical surroundings. Get the farmer started to spraying for insects and fungi, and he will begin to ask questions about the causes of the results he gets. He will naturally ask questions about other operations on the farm and in the orchard, and he thus becomes a scientific farmer unconsciously, and in spite of himself.

Much still remains to be done which a field force, such as ours, alone can do. We must keep those people going which we have started, so that others, noting their success, will follow their example. The fruit industry of Pennsylvania should be extended. While little spots of the State have been devoted to fruit growing,

which grow anywhere south of the latitude of forty-one degrees, are yielding a golden harvest to the intelligent orchardist. We have the markets at our very doors, and it behooves the State to develop these untouched resources. There is probably no state in the Union possessing equal advantages of nature and market, and next to mining and manufacturing, fruit-growing ought to be our greatest industry.

I believe the services of the field force can be improved by instituting a system of promotions based upon length of service and efficient work. No system of service is complete unless it holds out rewards to the faithful and competent worker and provides for the dismissal of incompetents and sluggards. When these rewards are not offered the best men naturally gravitate toward good positions elsewhere, and the mere hangers-on, who are not worth their salt elsewhere, may remain, thus constantly lowering the standard of the entire body.

We have 67 counties, and about 20 regular inspectors, including in each man's district from two to four counties, according to number of orchards and nurseries they contain. By re-districting the State into as many divisions as there are inspectors, giving each man full charge of his district, including nursery inspections, the entire State could be supplied with resident inspectors, thus saving time and expenses, and improving the service to the citizens of the State and resulting in the permanence of the service and the preparation for a higher grade of work, and consequently giving an impetus to horticulture, and incidentally to agriculture, such as the great State of Pennsylvania needs, deserves, and can have.

On the part of the field men, there should be close study, honest application to the work and enthusiasm in the same. We are engaged in a great and noble cause. We should ever remember that this great work was conceived in the mind of our chief, Prof. Surface, and that his energy, foresight and diplomacy have carried it on through four stormy and troublesome years, beset as he was by foes without and enemies within the State. This work was an experiment, and we were put on probation. We have made good. The credit belongs to Prof. Surface and those of us who have at all times been loyal in our sentiments and service.

By a prophetic foresight, the use of lime-sulfur sprays was chosen as the safest, surest and most available material to combat the scale. After all the years of compounding and exploiting of sprays, the original position taken by our chief is still impregnable, in spite of a continual bombardment of shot and shell from the guns of the oil manufacturers and their satellites. What would the Division of Zoology be today if it had advocated at any time any other spray but lime-sulfur? It requires no genius to see that its very name would be a by-word and a reproach, and the inspection force would ere this have been relegated "back to the tall timber."

It remains for me but to cite examples of profitable fruit growing in my district, and I shall have finished. Among many I submit these: Dr. Funk, of Boyertown, sold \$2,700.00 worth of peaches per acre in a 10 acre orchard in six years. W. E. Grove, of York Springs, sold \$1,500.00 worth of peaches this fall from 350 6-year-old trees, and sold them too cheap. J. R. Yentzer, of Conestoga, makes an independent living from 200 peach trees in his back lot. R. E.

Adams, of Lancaster city, receives five cents each for his peaches at his orchard. Saml. Bream received \$5,000.00 for his 40-acre apple crop on the trees. W. S. Adams, of Aspers, sold 2,000 barrels of apples from 60 acres of young orchard planted on mountain land, originally worth \$3.50 per acre.

Dr. I. H. Mayer, of Willow Street, Lancaster county, picked 4,000 bushels of apples from 19 acres and sold many of them at 15c. a strawberry box, and \$2.50 per bushel box.

John A. Scholl, of Adams county, sold this seasons crop for \$10,000. Nearly all of these were grown on an orchard which he bought two years ago and which cost him, including 80 acres of farm land, about this sum. This fine crop was saved from a bad infestation of San José Scale by the commercial lime-sulfur ("Orchard Brand") after the oils had failed miserably.

ALLEGHENY COUNTY.

Inspector, WILLIAM G. GISH, 187 Shetland Ave., Pittsburgh, Pa.

Orchards inspected during the year past have been found in better condition as to San José scale than those of the previous year; less than 50 per cent. of the orchards being infested with the scale, and with but few exceptions it would not exceed 15 per cent. of the trees in the orchard were found. Oyster Shell scale and Scurfy scale predominate, and orchardists confuse these with San José. I visited the orchard of Mr. J. C. H., Robinson township, Carnegie, R. F. D. No. 3, which contains 200 bearing apples, 200 young apples, 200 bearing pears, 400 bearing peach, 500 young peach, 300 bearing plums, 25 young plums, and 50 bearing cherry; all these trees were infested with San José scale, except the young peach and plum trees, or possibly 75 per cent. of all the fruit trees. The bearing peach and apple orchard was entirely ruined by the ravages of the pest. The owner was not aware of the cause of decline of trees. He became interested, and promised to spray this fall with lime-sulfur. He had been spraying with a solution of lye and oils. I re-visited the orchard of Mr. M. A. A., of Indiana township, and found he had sprayed 675 young trees, infested with San José scale, using lime-sulfur solution. Owing to a strong wind from the south, he only sprayed the southern side of trees. The subsequent inspection showed that the side sprayed was entirely free from the insect, and the unsprayed side showed increased evidence of the pest.

From close observation, where San José scale, Oyster Shell and Scurfy scales were present, I have found that the lime-sulfur solution is the most efficient spraying solution for the control of such pests, and if used properly, will ultimately eradicate the trouble. But very little spraying with lime-sulfur has been done in this county until recently, and where used it has given good results.

I have not found any trees injured to any extent as results of spraying, except in rare instances, where Bordeaux-arsenate, or Bor-

deaux-Paris-green, had been used at greater strength than should be—thus causing a russetting of the fruit and some injury to the foliage.

Codling Moth, Woolly Aphis, Tent Caterpillar, Canker Worm, Oyster Shell and Scurfy scales are more numerous than any others of the insect class. Very little has been done to control these except in rare instances. Spraying has been done for the codling moth, but more spraying has been done during the year past than any year previously for ten years. Where the Bordeaux-arsenite solution formula, advised by this Department, has been used, it has produced good results.

The interest taken in our work now is greater than it was two years ago. Commercial orchardists and those having family orchards are willing to co-operate with us. Two years ago an inspector was practically unknown. They now look upon our visits with pleasure, and have shown a very decided interest in our work. They are willing and anxious to accept advice for the betterment of their orchards.

I am pleased to report that your inspector is received with welcome wherever he goes, and every courtesy is extended. I am earnestly requested to not postpone my next visit. In fact, I would be kept busy making return visits. When shown the results of lack of attention to their orchards, to protect them from the insect pests, they look upon it as a serious matter, and are anxious to have our advice and assistance.

Extensive plantings of young orchards have been made during the past year by persons who intend having large commercial orchards. A number of old orchards are being renewed. From observation and information received, orchards have been neglected and permitted to decline during the past ten years, for several reasons, viz: Deficiency of farm labor; time given to other farm crops; the extension of city limits; the erection of manufacturing plants in proximity to farm territory, making rural and agricultural property more valuable for manufacturing, resident, and business purposes; smoke, soot and fumes from furnaces, effecting destruction to vegetation and great discouragement to the grower.

The former and fruit-grower, notwithstanding the obstacles they have to combat, have shown a willingness to co-operate with your inspector and the Department. Approximately 50 persons have bought or signified their intention of purchasing spraying outfits and commencing systematic spraying. Others, with outfits, were discouraged and had discontinued spraying, but have said they would again take up the work.

I am of the opinion that the suspension of the work at this period would result disastrously to the farmer, the fruit grower, and the Department. All the farmers and fruit growers visited have renewed their energies to place their orchards in good productive condition, expecting subsequent assistance from this Department, and no doubt they will further look for and expect it. It is a fight from the word "go" to raise fruit of any kind now, and we must continue to give our advice and aid.

The most important undertaking of the Department is the orchard demonstration. During the past year a number of orchardists, residing on main roads leading through several townships, have pur-

chased expensive spraying outfits. Material and labor are furnished at their expense. The work is done under supervision of the inspector. Farmers, orchardists and others, passing, notice the work being done. They become interested, and watch results.

Considering that the work in this county is comparatively new, and owing to the inclement condition of the weather during the past two demonstrations, the attendance at the demonstration meetings was small. This again may be owing to having only one demonstration orchard in this county (one of the largest in this State), the attendance generally being from those residing in the immediate locality. I would suggest, that, so far as possible, demonstration orchards be established in each township, selecting a state, county or city institution where suitable; otherwise, selecting an orchard where the owner will furnish outfit, material and help. This should obviate a semblance of partiality. The demonstration should be held under the auspices of this Department, and conducted by the inspector of the county. This will give the residents of each township an opportunity to attend the demonstrations without much inconvenience or loss of time. It would cause those from isolated parts to become interested and inspired by the results. It would develop a much larger attendance, and the missionary value of such effort, if well undertaken and done, is beyond conception.

I have been requested by a number of orchardists to suggest to the Department the advisability of having enacted a law on compulsory spraying, instead of having the Department coax indifferent persons to better their conditions, financially and otherwise.

We firmly believe that a law, strictly enforced, providing for the treatment of certain pests in this State, would be of immense benefit in producing much larger crops of better quality; but it is not our duty to incur the enmity of our farmers by prematurely attempting to bring about such legislation. As soon as they realize its importance and request it properly, such law will doubtless be enacted.

BEDFORD COUNTY.

(See Inspector Lee's Report for Somerset County.)

Mr. Lee's counties: Bedford, Blair, Cambria and Somerset.

BERKS COUNTY.

Inspector, J. D. Herr, *Lancaster, Pa.*

premises and the large majority of the individual fruit trees are more or less seriously infested with San José scale. Expressed in percentages I would say about 100 per cent. of the orchards and 85 per cent. of the trees are infested. I say "about 100 per cent." for infested orchards advisedly, since of the thousands of orchards I have inspected my reports will show that I found, two years ago, one orchard in Lancaster and two in Berks apparently free from scale, but I believe these have become infested since that time. The percentage given for infested individual trees is estimated.

In answer to the question, "Is the San José scale increasing or decreasing?" I beg leave to say that upon live trees, receiving no treatment, the history of San José scale infestation is uniformly a constant increase of scale until the tree dies. Nowhere have I found this pest destroyed by predacious insects or disease, and the expression one often heard a couple of years ago, that "The San José scale has voluntarily left the country," is now never heard.

I have met a few cases where peach trees had been killed back to the trunk by scale; then after being "dehorned" have grown new shoots and born fine fruit without treatment. This, although seeming strange, is to be explained on entirely natural grounds. The scale living upon the limbs and twigs and not upon the rough or glassy bark of the trunk, having killed these twigs, itself died for want of substance. The tree, being dehorned, was thus free from live scale, and the young wood, bearing within 18 months, was not yet seriously infested from outside sources.

There is plainly less scale in orchards which have been properly sprayed according to the instructions sent out from the State Zoologist's office.

There are a number of materials which, when used in sufficient strengths, are fatal to scale insects. In my observation, Whale Oil soap, 2 lbs. to 1 gal. water, Crude Petroleum, Kerosene Emulsion (10 per cent. Kerosene), Proprietary Oils, Commercial Concentrated lime-sulfur solution, home-boiled lime-sulfur wash and Hydrocyanic acid gas fumigation, all will kill San José scale. As to different dates of spraying, the general statement is made that fall spraying with oils and spring spraying with lime-sulfur is most effective in killing scale. On this point, I have not had the privilege of comparison, but I do know that the use of oils in the spring has frequently killed the fruit buds where part of the orchard was sprayed with this material, while the other part, sprayed with lime-sulfur, bore abundantly. For this reason, oils, if used at all, should be applied in the fall or early winter; while lime-sulfur, because of its fungicidal effect, if preferably used in spring. I have found a few cases of failure in the use of home-boiled lime-sulfur wash, and upon close investigation, poor materials, inadequate boiling, or incomplete spraying, either one or more, were the sole cause. In one case, I found that each boiling of 50 gal. of spray fluid, when strained, left at least one peck of undissolved lime. This constituted almost the entire 22 lbs. used. Consequently the fluid had not the proper strength to kill scale. The lime in question was secured from a neighboring kiln where only agricultural lime was burned, and, I suspect is of inferior quality. Of course, improper slaking will also render lime insoluble.

Failure with concentrated lime-sulfur solution is sometimes met with on account of too weak dilution; viz: 1 part of the solution to 15 or 18 parts of water.

Among inefficient sprays must be mentioned Caustic Soda solution. All commercial or proprietary miscible oils at such strengths recommended by the manufacturers of the same; that is, 1 to 20 or 25 of water, carbolic acid solution, and concentrated lime-sulfur solution diluted above 1 to 10, and unboiled lime-sulfur.

Materials injuring the trees comprise pure crude petroleum, pure kerosene, proprietary oils in any effective strength, and strong caustic soda solutions. Injury from these sprays results to both tree and buds. On the other hand, I have never noted any case of injury from spraying with either the home-boiled lime-sulfur wash or the concentrated lime-sulfur solution at any reasonable strengths.

In some parts of the territory through which I travel the damage done by borers is quite serious. The remedies found effective are: 1st, preventive, such as applying alkaline mixtures (as whale oil soap), strong lime-sulfur wash, or even soap and whitewash, to the trunk of the tree, in the case of peach; and these, in addition to oil paint on apple, pear and quince, in the month of June, are apparently effective. 2nd, curative, which consists of cutting out of the tree in spring and fall such borers as enter; and carbon bisulfide in the case of apple borers too deeply seated to cut out.

Codling moths and curculios are becoming a more and more serious menace to the fruit grower. These are effectively controlled by arsenical sprays.

Green and black aphids caused much damage during this season, constituting almost a plague in some localities. The usual remedy applied is Kerosene Emulsion, but unless used early in the season it seems to be inadequate. This is no doubt due to the difficulty in applying any spray to these insects when protected by the curling of the leaves. The same applies to spraying with tobacco decoction.

The public is, as a rule, much interested in the field work of the Division, and the inspector is received with much interest. To such as have benefitted by his advice he becomes an oracle to be consulted on many occasions. The selection of orchard sites, selection of varieties, pruning, spraying, buying, and in fact all kinds of questions on subjects upon which the Chief of the Division is consulted daily, become themes for discussion and questioning wherever he goes. Even the holy Sabbath day is not sacred to these questioners. I am mentioning this to show the intimate relations which should and do exist between the field agent of the Division and the farmer and the fruit grower.

True, the advice given is not always followed, but much has been and is being accomplished as the direct result of our efforts. Young orchards are, as a rule, taken care of. No one is planting these days except such as have determined to spray. Who can blame the average farmer if he is appalled at the problem of spraying 40 foot trees with an outfit equipped with a six foot extension rod, especially as he has never been accustomed to do such work. He concludes he will let his trees die and buy his supply of fruit. It is cheaper, he says; but he will change his mind. He only misses the water when the well runs dry. The farm orchard will again be planted, and the farmer having profited by his experience, will spray.

Commercial orchardists are following the teachings of this office more and more year after year. There is increased interest manifested in fruit growing all along the line, due largely to our campaign. Lancaster county has shown her interest, not only by her attendance at our public meetings, by letters to the inspector, and the office and personal consultations, but by planting both farm and commercial orchards. One local nurseryman reports that he alone sold 5,000 trees to be planted in this county this fall, and he covers many counties of the State. This increased planting is in a large measure due to the work of the Division of Zoology, which holds out the promise, backed by actual demonstration, that trees can be grown and pests held in check with the knowledge and means at our command.

Much of this planting is being done by young men of energy and intelligence, who become apt students of Prof. Surface and his assistants. This is a very hopeful sign, and will yield large results in the future.

BLAIR COUNTY.

(See Inspector Lee's Report for Somerset County.)

BRADFORD COUNTY.

Inspector, D. A. Knuppenburg, *Lake Carey, Pa.*

(1). There is considerable San José scale found in my district, and it is increasing. About ten per cent. of the orchards are infested. Along the river, railroads, and river towns, nearly all orchards are infested and usually every tree. Back in the country we often find one or two trees or shrubs infested on each place.

(2). The most effective remedy, when the welfare of the tree is taken into account, is the lime-sulfur wash. In cases where the lime-sulfur wash has not been satisfactory, I think the failure can be traced to faulty material, making or application.

(3). I found where "some kind of oil" had been used, trees were injured, but the party did not know what it was,—only something he bought.

(4). Other serious insects found are Codling Moth, Borers, Curculio, Canker Worms, Oyster Shell Scale, Scurfy Scale, Putnum's Scale, Lecanium, Tent Caterpillar, Fall Web Worm, Pear Psylla, Cherry Worm, Apple Maggot, Pear and Cherry Slugs, Green and Brown Aphids, Wooly Aphis, Aspidiotus aencyclus, Red-necked Caterpillar, etc.

(5). The public seems, as a whole, to take deep interest in the inspection and demonstration work.

(6). The inspector, as a rule, is well received in my district. The reasons for the few exceptions are ignorance of our work and inability on the part of some tree owners to discover the true cause of their

own failures. Most people agree that our directions are good, and that they must look after this matter of pest control.

(7). The outlook for orcharding is very encouraging in Wyoming county. As examples of successful orchardists, I would cite Samuel Egleson, Vernon; Elias Treible, Vosburg; John Henning, Mehoopany; Cora Burgess, of Forkston; F. H. Fassett, Meshoppen; James Knuppenburg, Tunkhannock, and many others.

Bradford county is about one-half worked, and, I have found but few who are making much progress, though several are ready to launch out on our advice. The reason is because of a lack of knowing how to grow trees and produce clean fruit.

(8). The farmers and fruit growers are taking marked interest. In Luzerne county, W. J. Lewis and brother asked to have the State take charge of a portion of their orchard of two thousand and three hundred trees, which was done as public demonstration work. Hundreds of people have visited the place,—several traveling nearly two hundred miles to view the work and its results. One of these men, a Mr. Ellsbree, from Athens township, Bradford county, expressed a desire to set a fifteen acre orchard next spring, and asks to have State aid. Another, Mr. Estabrook, of East Athens, Bradford county, was delighted with what he saw, and said to me he would not take five hundred dollars for the knowledge gained by his trip, and now he is going to drop other lines and give all attention to fruit-growing. He is a representative man, and I predict success for him. In speaking of the Lewis orchard, Mr. Estabrook said he had not thought such a sight possible. Many are taking hold in a smaller way.

(9). The result of suspension of the inspection and demonstration work would be very detrimental to the best interests of the State and people.

(10). For improvement of the service let every man grow with the great work before us. Use plenty of energy and good sense, listen closely to instructions, and hold up the arms of our superior officer.

In looking around we see fields ready for the harvest. We meet people who are looking to us for relief from the drudgery that makes people shun the farm. I believe the problem that our Honorable Leader has undertaken to solve is one of the greatest subjects now before the people of Pennsylvania. The word "fail" is not written in *his* vocabulary, and we trust that *his* untiring energy, with his corps of faithful workers, will leave a wholesome knowledge of fruit-growing that will not only enrich the people, but also build up an industry now within our reach that will put our own State of Pennsylvania to the front, where she rightfully belongs. Without this great work Pennsylvania would feel a just rebuke.

BUCKS COUNTY.

Inspector, E. L. Loux, Souderton, Pa.

During the last year we have been kept busy examining orchards and shrubbery in staid old Bucks county. For the greater part of this time we have been engaged on orchard inspection in the central

portion of the county. At present, inspections are being made in the northern portion, adjacent to the Northampton border.

The work has been very pleasant during these months and it is safe to say that the result will be increased interest in fruit culture.

Unfortunately, Bucks is an extremely infested scale bailiwick. At least ninety-five per cent. of the orchards are infested with San José scale. In unsprayed orchards, it is steadily increasing and threatens their speedy destruction. Many orchards practically clear of scale two years ago, are now scaled to the verge of death. If heroic measures be not taken by the owners of such orchards, they will soon be beyond redemption.

While we have said that ninety-five per cent. of the orchards are infested by this dreaded pest, the degree of intensity of infestation varies greatly. In the majority of them, practically every tree is suffering from their ravages. In others only a few trees are thus affected. It is, however, safe to say that seventy-five per cent. of the trees examined were scaled.

The remedies used are in general those suggested by the bulletins of the different State Departments or their experimental stations. Among the principal we mention home-made lime-sulfur, the various commercial brands of lime-sulfur, the commercial oils, especially Scalecide and Target Brand, Caustic Soda, Lewis' Lye, etc.

Of these, lime-sulfur, home-made, has proved most efficient. In all cases where it has not controlled scale, such instances may always be ascribed either to improper preparation or careless application. Lack of proper boiling has been the most common error of preparation. In some instances, we have found it simply a mixture of lime lumps and sulfur grains, of a light yellow color. Such a mixture can not reasonably be expected to kill scale. In the matter of careless application, such work is most commonly done by would-be professional sprayers, who do their work "by the job." With them it is a matter of the number of trees sprayed, not the character and efficiency of the work done. In one instance we saw one of these charlatans slightly spray the trunks of apple trees with a bucket sprayer, using a commercial solution about one to thirty. He had the audacity to charge thirty cents per tree and then hastened to the nearest hotel to enjoy the proceeds of this robbery. He avowed himself greatly wronged by our comments on such slipshod work. Nothing else has done so much to give spraying a black eye. Every one who thus creates a sentiment against spraying is indeed an unworthy servant and should be exposed.

The commercial lime-sulfur in the proportion of one to eleven is too weak to clean a badly-scaled tree. When used one to eight or in extreme cases, one to six, it proves very effective. We saw an instance where it was used one to one on a badly scaled tree. It cleaned up the scale and did no injury whatever to the tree.

Scalecide, according to our observation, is the best of the oil sprays. We have seen orchards where it has done fine work and a few instances where it has produced injurious effects on the trees, excepting on peach trees, where its continued use can not safely be recommended. At one to twenty it kills only a moderate per cent. of scale, and it should be applied at one to fifteen. A rather high pressure should be used in its application; dripping is dangerous.

Target Brand has proved unsatisfactory in two respects. In many cases it has utterly failed to control scale, while in others it has killed the trees. The vicinity of Springtown shows abundant evidence of the latter. Many of our dealers have discontinued its sale.

Results obtained from caustic soda or lye are very variable and they can not be classed as effective scalecides. Washing the trunks with carbolic acid has been proven in no sense beneficial by a number of Bucks county fruit growers.

As to the dates for spraying, we do not find much difference in effectiveness. Fall spraying in this county proves to be of as great value as that done in the spring, if we discard the fungicidal features. February spraying seems to give the poorest results, owing to the fact that this month is a tempestuous one, with frequent heavy rains. As to the Target Brand claims of fungicidal benefit, we have not been able to find their claims verified.

But the different species of scale are not the only serious menace to successful orcharding in Eastern Pennsylvania. The Codling moth, an old but dangerous insect, is prevalent in this section. As a rule, from fifty to seventy-five per cent. of the apple crop is wormy, and thus the value is decreased by many thousand dollars. Unfortunately but little effort has been made to rid us of this voracious pest. In orchards where the Bordeaux arsenate has been used, the results have been very beneficial. One thorough spraying after the dropping of the blossom-petals has answered the purpose.

Both the round-headed and the flat-headed borers are doing serious injury in many apple orchards; and their ravages seem difficult to control. We advocate painting the trunks either with white lead or lime-sulfur sediment.

Peach borers are a serious pest in eastern Pennsylvania and have been an important factor in the ruination of a number of peach orchards.

It is a great pity that no vigorous campaign is instituted against caterpillars. In a number of young orchards, this season, they practically defoliated the trees. We should earnestly advocate their destruction.

We received very many letters about the Angoumois grain moth, during the last few months. It is a very serious pest in Bucks county, being occasionally found even in corn.

Our work is daily being more appreciated by farmers and fruit growers in Bucks county. There are many requests for special inspections and re-inspections, which we are unable to give. The amount of correspondence is daily increasing and the questions asked

As to our reception in the district, nothing more could be desired. In every instance we are courteously received, and in many cases pertinent questions are asked. Sometimes the reason for the inspection must be explained to the good housewives, who fear it may mean either personal expenses or taxes. Often considerable time must be given to the examination of ornamental plants, with suitable advice as to their insect pests or plant diseases. In some cases there is considerable doubt expressed as to the utility of spraying. If there has been a failure in controlling the scale nearby, such orchard will be quoted as the horrible example.

Others will have pet remedies to advocate and will claim marvelous results from their use. But unfortunately, such claims can never be verified. Yet, taken as a whole, a very healthy sentiment in favor of spraying has been created, with lime-sulfur rapidly gaining favor. In this county the amount of spraying done has increased one hundred per cent. during the last year. This percentage has increased far more rapidly in inspected districts than in those not yet visited. The outlook for fruit growing is fair. While most of our farmers make specialties of grain growing and dairying, yet most of them desire fruit on their premises. To secure this they are beginning to realize that greater care is needed; and they are ready to take our advice.

The planting of fruit trees is again rapidly increasing in the county. This is especially true of peach trees. There is but little planting of plum trees. The new orchards being planted are rather larger than the former ones. The quality of the trees planted is also better.

Among our most prominent orchardists are E. W. Paxon, New Hope; Thomas Knowles, Oxford Valley; Ed. Kiser Estate, Springtown; Lewis Gannsle, Springtown; Emmanuel Oppenlander, Passer; Ed. Johnson, Dolington; Caleb Scattergood, Yardley; The National Farm School at Farm School; Mr. Krause, Riegelsville; Wm. Balderston, Yardley (Morrisville); Thomas Sassaman, Ottsville; and Joseph Diehl, Bedminster.

The peach orchards give fine profits; many apple orchards are doing well for the owners, although the Smith's Cider is too generally grown. They are gradually being superseded by better varieties.

Bucks county has several granges and quite a number of farmers' clubs and, as a result, there is some co-operation. But old ideas and time-worn theories still too often hold sway. In many cases, unlike the Missourian, they will not believe, even when shown. From lack of co-operation, the proper advantage is not taken of the best methods, the best advantages, and the best markets. What is needed is more consultation, more discussion of methods, and intelligent discussion of results; thus insuring the seizing of every opportunity for better harvests. We hope there will soon be organized a live fruit grower's association. The demonstration orchard is now the only common bond of sympathy.

Most of the aroused interest in fruit growing can be properly ascribed to the Department of Zoology. At first much of the seed fell by the wayside, and the fowls of jealousy and misrepresentation devoured it. But here and there, some seed fell on fruitful ground

and are now bearing harvest a hundred fold. The practical value of our work is being recognized, and its real usefulness is daily becoming more evident to the citizens.

The discontinuance of the service now would halt the new movement toward scientific fruit culture and an earnest war against insect pests.

The service should be made a permanent one, so as to bring us into still closer touch with the fruit interests. We should be given more control over the nurseries, and more stringent supervision over the shipments from foreign nurseries.

The appropriation should be made greater, so as to provide ample funds to carry on the work in a logical manner. We should be more closely identified with the Farmers' Institutes, where we deserve recognition.

Working hand in hand along these lines, Pennsylvania could be placed where she deserves to be, at the head of the fruit-growing states.

BUTLER COUNTY.

Inspector, F. L. McClure, New Wilmington, Pa.

In Butler and Venango counties I find that almost every farmer has some kind of an orchard. As a general rule the orchards are small in the number of trees, but the trees are very large.

A great many of our orchards have been poorly pruned, and a large number seldom pruned at all. What pruning is done, in general, among the orchards, is to prune off a few of the lower limbs with a saw or an ax, in most every case leaving a long stub to rot back into the body of the tree.

There are few commercial orchards in Butler and Venango counties, most of the fruit being used for home consumption. We have at the present time quite a few good young commercial orchards started, and more being planted every year. At the present time our conditions for fruit are not good, as so many of the orchards have passed their usefulness, and our young orchards have not come into bearing. The orchards want for lack of pruning and cultivation. Some of the orchards are pruned high and farmed, but a larger portion of the orchards pastured with stock, which always damage the trees to a large extent.

I find very little San José scale in Butler and Venango counties. I can not say whether or not the scale is increasing, as I have not inspected any territory the second time. I do not find more than five to ten per cent. of the orchards infested with San José scale. I find very few orchards where the scale is spread over the entire orchard. I often find the San José scale on or near a young tree which has been killed in the orchard, or along one side near a young infested orchard. Few of our old orchards are infested with San José scale.

About the only remedy used is the boiled lime-sulfur wash, home-made. I have not noticed any difference in results from spraying at different dates. I often find scale where the lime-sulfur was used. In these cases I find that the lime-sulfur has not been boiled long enough, or has not been applied with a good spray pump.

I can say nothing in regard to remedies inefficient for the control of the scale.

I have found the Canker worm, Codling moth, Wooly aphis, Scurfy and Oyster-shell scale doing serious damage. I find a few that have sprayed for the Canker worm, with good results from the use of Paris green. The other insects I have mentioned have not been treated.

I can say that the people of Butler and Venango counties are taking much more interest than they did when I started in the work two years ago last June.

The inspector is now received far more cordially than he was formerly. The fruit growers are now willing to follow our directions, as a general rule.

The outlook for orcharding is now better than it has ever been before.

I am very much pleased with the way the farmers are co-operating to the extent of taking an interest in the work of pruning, spraying and planting. I went to one of my Demonstration Orchards to do some spraying, and then went to Mercer to buy some spraying material. I could not find any Paris green, arsenate of lead or copper sulfate in the town. I was encouraged to know that all the spraying materials had gone to the orchardists to be used by them, although I had to drive ten miles to another town to get the material for my demonstration the next day.

CAMBRIA COUNTY.

(See Inspector Lee's Report for Somerset County.)

CAMERON COUNTY.

Inspector, E. L. McNETT, Roaring Branch, Pa.

Mr. McNett's counties: Cameron and Tioga.

Cameron county can not be classed as a fruit county. The valleys are narrow and frosty, and the hills very steep and stony. There are few settlements on the mountains, and the soil appears to be

thin and cold. There are less than a dozen orchards in the entire county, whose owners are trying to improve them. Except at Sinnemahoning, no San José scale was found, but everywhere Oyster Shell scale is very abundant. Not only in orchards but in the woods, especially on ash and butternut, it is very prevalent. At Sinnemahoning about a half dozen cases of San José scale were found in the village, and two cases in Grove township adjoining. The owners readily agreed to spray with lime-sulfur wash, and will try to prevent it getting a foothold.

In the eastern part of Tioga county nearly every farmer has an orchard of from 50 to 300 trees of apples. Not much other fruit is raised in Union township. Twenty-three cases of San José scale were found in the village of Roaring Branch. They were all on young trees, and the owners were not aware, as a rule, that they were on their trees. Nothing has as yet been done to check the ravages of the pest, but they will try to exterminate it this season. There is very little Oyster shell, and scarcely a trace of any other scale, but many of the orchards are neglected, untrimmed, not cultivated nor sprayed, and Codling moth is found everywhere. About the only nice fruit I saw was grown in orchards where hogs or sheep ate up the fallen apples and thus destroyed the pests. Quite a number of the enterprising farmers are caring for their orchards, and much interested in being awakened in the matter. Very many inquiries are being made regarding the demonstration orchards, and with the great natural advantages offered by this section of the country, this will soon become a great fruit country.

A few daring ones have set out and cultivated peach orchards, and have reaped a golden harvest therefrom. Plums, cherries and peaches yield an immense crop, but black-knot is very prevalent, and but little attention has been paid to it as a rule. In young trees borers are nearly universal.

The people as a rule receive the inspector gladly and are anxious to learn. Too many know nothing about the objects of the inspection. It would be well to have the inspector, during the winter months, deliver a lecture in each school district in his territory, explaining the matter in all its points of bearing, so when he visited the territory later the seed would not fall on barren ground.

CARBON COUNTY.

Inspector, F. R. FERTIG, Lebanon, Pa.

the orchards are very badly infested with the scale. Very little planting has been done during the past several years, excepting here and there, and not on an extensive scale.

In Carbon county it is vastly different. While I have found about fifty per cent. of the orchards in that county infested (so far as I have gone), and some of them very badly, the trees, taken as a whole, are in much better shape, the scale not yet having had time enough to so completely poison the trees, as in Lebanon county, but more orchards were found suffering for fertilization and cultivation.

2. Where the lime and sulfur solution was used the scale, as a rule, is under control. So far as my observation goes there is little difference in the matter of season in treating the trees with the solution, so long as the application is made properly and thoroughly when the tree is dormant.

3. In quite a number of cases I have found excellent results secured from the use of Scalecide. If the liquid is kept thoroughly agitated and mixed during the application, good results may be attained. On the other hand I have seen some bad, yes, *very* bad, results which were attendant upon the use of Vacuum oil, due, in my judgment, to the difficulty of keeping the mixture uniform at all times during application. As the oil does not properly mix with the water some trees will be treated with all water, and others with all oil during the application. Where only the water is applied, the scale continues to flourish, and where all oil is applied, the tree suffers serious injury. As a rule the mixture is applied in the proportions of one gallon of oil to 19 gallons of water.

4. In Carbon county, more so than in Lebanon county, I found many fruit trees badly infested with scurfy scale, oyster shell scale, and also plenty of borers. In numerous sections in Carbon county the scurfy scale is looked upon as the San José scale.

5. As to the question of the public maintaining a proper interest in inspection and demonstration work, a bit of my own personal experience will suffice for an answer. When an orchardist drives from eight to ten miles to bring an itinerant inspector to his place, takes the man back to his starting point again, and then keeps an eye on the regular county inspector, and goes through the same operation again, begging the visitor to remain for a full half day explaining the work of tree cultivation, one may safely say the orchardist is properly interested. This is a frequent occurrence. They met inspectors at every turn of the road, and driving over mountains and hills is considered no sacrifice if an inspector can be secured to give a demonstration. Not infrequently the same interested tree grower will drive a long distance the same day to see the inspector demonstrate at some other orchard, and even follow him to his stopping place to hear the question further discussed. I have known these inquiring farmers to drive after the inspector on his tour, and stop at places along the line with the visitor, so as to make sure that he does not skip their own places which sometimes are located off the usual line of travel. Men with large farms often send their superintendents after the inspector to gather information as to the proper methods of cultivating trees. In citing these experiences, I wish to emphasize the fact that they are not isolated cases, but experiences

frequently to be met with on a tour of any district. Surely this answers the question as to whether the public is interested. Here is a letter characteristic of those often received:

Campbelltown, Penna., October 27, 1909.

My Dear Mr. Fertig: I was at your place for a social and business chat regarding spraying machinery and spraying solutions, but you were not at home. Would like to hear of some of your experiences as to results secured from spraying, etc. Should you come up our way, would like you to stop and give your verdict as to my trees. Yours truly, etc."

6. As I indicated above, the inspector is a welcome visitor at any farm where there are fruit trees. Frequently the whole family accompanies him into the orchard, and often note-books are brought out to preserve the scientific truths he expounds. Very often the inspector is asked to write on a piece of paper the formula of solutions used in demonstrations, and there are many other evidences of deepest interest. And, what is more to the point, the tree owners do their best to put into practice what they learn.

7. The outlook for orcharding is growing more favorable in Carbon county, as well as in Lebanon county. During six weeks of inspection work in Carbon county, I met with a number of persons who contemplate planting on an extensive scale as soon as they are assured that climatic conditions and the state of their soil are conducive to successful ventures in that line. Among them are: J. F. Hottenstein, A. S. Seager, George Graver, Daniel Smith, Dennis and Abraham Strohl, W. E. Ash, Amos Jones, Reuben Kemerer, W. O. Lentz, and C. A. Rex.

8. Farmers and fruit growers in Lebanon county are fairly well organized through the medium of granges, and agricultural and horticultural societies, and through these organizations manage to profit extensively by co-operation. Several largely-attended farmers' institutes were conducted during the year, and the beneficial effects were fully in evidence when H. C. Snavely, Moyer brothers, and J. H. Yeiser,—all extensive fruit growers,—not only disposed of their entire crops at good prices, without shipping any out of the county, but aided the smaller growers to conduct their sales on the same economical lines.

Carbon county growers are not organized and consequently each individual disposed of his crops last summer as best he could, and at prices not at all uniform. This difference in conditions was manifest in the fact that Lebanon county fruit growers received better prices for their wares than those who shipped goods into the county from other points. Just the reverse was true in Carbon county.

9. If the work of the inspector should be suspended at this time, it would undoubtedly result in irreparable loss to many fruit growers. It would be a particularly hard blow to those who have recently started orchards by the encouragement given by the State department, and especially to the growers who are far removed from larger establishments where they might get assistance and advice. Selfishness and commercialism, to say nothing of competition, are elements to be reckoned with in the business of the farmer and fruit grower,

as well as it is the commercial and industrial world, and for the State to desert the small and inexperienced growers at this time would be to place them at a great disadvantage, and would, in my opinion, be a great loss to them. Successful farmers and fruit growers are sometimes met who refuse to divulge the secret of their own success to their less fortunate neighbor, and who are too narrow-minded to give the neighbor a chance to profit by the experience gained by themselves.

A case of that kind came under my observation not so very long ago. A young man started an orchard, and then took a job in iron works thirty miles distant, to earn a living until his trees should reach maturity. No one would volunteer him a bit of advice or suggestion, and when opportunity afforded, he lost a day at work and hunted up the inspector to seek information. [He is now profiting by the advice and instruction he so greatly needed.—H. A. S.]

10. In the way of suggestions, I think that the inspectors' work would be expedited considerably by having at his disposal printed cards with the different formulas used in spraying. As mentioned above, the inspector is frequently asked for these formulas, and if he had them in printed form ready for distribution, much time would be saved. It might be well to have printed on the same card brief suggestions for tree pruning, urging fertilization and cultivation, etc., and signed by the chief of our Division.

I would also venture the suggestion that the Department take some action to prevent unscrupulous agents from charging exorbitant prices for commercial preparations, and especially those not recommended by the Department. I would also like to suggest that the blanks given inspectors for their regular service reports be put up in a more durable manner. If the blanks were provided with a perforated stub, the inspector would be able to keep a record himself of the data he secures on each inspection trip, and this would be of incalculable benefit on the occasion of succeeding visits to the same premises. The change, I am sure, could be effected with no great expense to the Department, and the benefits would be many.

CENTRE COUNTY.

Inspector, T. C. FOSTER, Winfield, Pa.

•Mr. Foster's counties: Centre, Perry, Snyder and Union.

Centre county, where the work of inspection is at present receiving attention, is not so very seriously affected by the ravages of the San José scale, except in the case of Rebersburg and vicinity. Up to this time inspections have been made in only five townships, and the results show about 20 per cent. of the orchards to be infested with San José scale, and about 5 per cent. of the trees, on an average. The

interest is growing in favor of the organization of a County Horticultural Association, which will probably take place some time this month. [Completed nicely, Nov. 20th.—H. A. S.]

The abandonment of the work which has been in progress for the past four years would doubtless prove a disadvantage to many fruit growers who have not yet been reached. The establishment of more demonstration orchards in each county where the fruit-growing interests are of sufficient importance to warrant it, would be a move in the right direction; but some modification should be made of the present arrangement of number of orchards for each Demonstrator to care for, so as to permit thorough work.

The press of the counties in my district deserve a vote of thanks for generosity in the publication of the required notices, etc., sent to editors. [It must be remembered that this office requires each inspector to keep the public informed, through announcements in the local press, as to just where he is working each week, so he can be consulted.—H. A. S.]

CHESTER COUNTY.

Inspector, FRANCIS WINDLE, *West Chester, Pa.*

(Report to be published in a future number of this Volume.)

CLEARFIELD COUNTY.

Inspector, JAMES BERGY, *Mifflintown, Pa.*

(Report to be published in a later number of this Volume under "Mifflin County.")

Mr. Bergy's counties: Clearfield and Mifflin.

DAUPHIN COUNTY.

Inspector, CYRUS T. FOX, *Reading, Pa.*

The inspections by the writer in Dauphin county during the year 1909 were in the districts south of the Blue Mountain. In several of these districts, notably Derry township, scarcely an orchard or fruit lot was left uninspected. An effort was made to cover each district as thoroughly as possible.

The conditions in every district, in regard to the ravages of the San José scale, were much the same. Not an orchard was found that had escaped its attack, and in some the work of destruction has been very great. This is especially the case in the limestone sections. In certain brownstone, or sandstone districts, the infestation was a less degree. That the pest is increasing is shown by an examination of earlier reports of inspectors, who returned reports of orchards as wholly exempt from scale, but which are now badly infested. The statements of farm owners also confirm this, as well as the condition of the trees, for while in certain localities trees have been killed, or are in their last stages, there are other sections where owing to the light infestation, it is apparent that it is not long since the scale obtained a foothold. Where there is such a general extent of infestation, it would be impossible to state any percentage as to the degree, except in regard to such orchards where spraying has been carefully and persistently observed. There it will be found there is but slight infestation, and the scale is kept under control. Unfortunately, such orchards are few.

The material that has been found most efficient by the writer in dealing with the San José scale is the lime-sulfur solution, made in the proportions of 17 pounds of sulfur and 22 pounds of lime to 50 gallons of water, prepared as prescribed in the Monthly Bulletin of the Division of Zoology. Where this solution has been thoroughly applied it has killed the scale, whether it was used in the fall, winter or spring. The lime-sulfur wash, however, has not been uniformly successful, because, (1) of lack of thorough application; and (2) perhaps on account of carelessness in making it, either in not using the correct proportions of lime and sulfur, or not boiling the proper length of time. (3) Desired results have also not been achieved because it has not been often enough applied, some persons having an idea that one treatment should last a year or two; and (4) owing to the use of gas sprayers, which destroy the value of the lime-sulfur wash by action of the gas on it.

The spraying materials that were undoubtedly inefficient, or unable to control the scale, were some of the commercial preparations, containing oil, according to the descriptions given. It is impossible to designate any particular article, as the applications were made mostly more than a year ago, and neither labels nor cans were retained. An exception as to this may be mentioned in the case of Mr. James Boyd, the owner of a number of farms in Swatara and Lower Paxton townships, whose orchards were very badly injured, and whose farm manager, Mr. Billet, informed the writer that the trees had been sprayed with "Target Brand" four years ago. Plenty of examples of trees, however, were to be seen where the bark had been badly damaged by the use of some oil preparation, and cases were told where the residue, after all trees had been sprayed, was poured around the trunks of tender trees, such as the peach and plum, near the farm buildings or in door-yards, and the trees were killed. Here was evidence, certainly, of the bad effect of applying an oil preparation too strong or in too great proportion.

As to other serious insects found in the districts visited, the scurfy scale was most general. Very few trees were exempt, and there were examples of trees with some branches as completely covered as though

a coating of white-wash had been applied. The Wooly Aphis was found to a slight extent and also some oyster shell scale. These pests were effectually fought where the lime-sulfur solution was used. In certain districts tent caterpillars were quite thick and this was the more astonishing in consideration of the fact that these pests make such a conspicuous display of their presence. It goes to show the condition of carelessness that prevails, and explains why other injurious insects are able to continue their work of destruction. The work of the codling moth is, undoubtedly, a matter of serious consideration, and the indifference manifested by the people, as to the loss sustained through its ravages in the premature dropping of fruit and the defectiveness of that which ripens, is deplorable. The curculio is all the cause of much loss. While the loss from these insects can be reduced to a minimum through spraying with arsenate of lead at the proper time, there is comparatively little of such spraying, and it can be safely said that 95 per cent. of the apples produced in orchards thus neglected are wormy and undesirable. Fungus disease, blight, peach yellows, and other troubles were found to be quite prevalent.

The public in general is not fully showing that interest in the inspection and demonstration work that should be manifested, and this is quite likely due to the fact that the extent of destruction and loss caused by the San José scale and other insect pests and diseases of tree and plant life, is just being realized. There is at last an awakening to the fact that something, which for many years was the source of so much enjoyment,—going back to childhood days,—“the old orchard,”—is rapidly disappearing. Where one man’s eyes have been opened, other people are now beginning to pay heed.

Consequently, the inspector is being given a cordial welcome. Farmers, whose trees have been ruined, are ready to plant again when given assurance that their labor will not be in vain, and when they are shown how, and also are made to see that they can hope for assistance from the Division of Zoology.

The outlook for orcharding in Dauphin county, accordingly, is good,—especially when there are such examples of success as will be found on the premises of Gabriel Hiester, in Susquehanna township; of Robert J. Walton, in Derry; of J. F. Eaton, in East Hanover; of John W. Early, in Lower Paxton; and E. C. Brinser, in Londonderry. The enterprise of Mr. Walton is, in particular, deserving of mention. He has commenced the planting of over four hundred acres of trees.

Farmers and fruit growers are, to a certain extent, co-operating in their desire to better the fruit conditions and save the orchards; but, on the other hand, there is considerable indifference. This in-

that it is useless to express opposition; while there are many who imagine that the scale will in course of time disappear, and they have made up their minds to wait until then, when they will re-plant.

Under all the circumstances, with the increase of insect pests to an alarming extent, and such a general infestation as has been discovered by the writer in his district, and with the people so anxious to be helped and willing to carry out instructions, it would be exceedingly regrettable if the inspection and demonstration work should be discontinued, or temporarily suspended. Such action would result in the undoing of all that has been accomplished by diligent effort in the past few years, and would practically relegate Pennsylvania completely to the rear as a fruit-producing state, when formerly it was our proud boast that this Commonwealth stood well in the front.

As to suggestions as to the improvement of the service, the undersigned knows of nothing that will so much conduce to good results as the proper appreciation and encouragement of the man in the field, who shows himself to be painstaking, energetic and diligent; giving him the opportunity of having under his direct supervision a few orchards where the good results of pruning, spraying and the care of trees, can be shown for the benefit of, and as object lessons for, each community,—such orchards to be made model establishments; and by utilizing the winter season for public lectures, demonstrations in orchards, and the organization of local horticultural societies, where matters of interest to fruit growers can be discussed and the inspector come still more intimately in touch with the people.

DELAWARE COUNTY.

Inspector, M. E. SHAY, *Holmesburg, Pa.*

Mr. Shay's counties: Delaware and Philadelphia.

(Report of Delaware county to be published later with Report for Philadelphia county.)

FRANKLIN COUNTY.

Inspector, E. C. BOWERS, *East Petersburg, Pa.*

extent (where no spraying is done) that the owners of orchards are taking the cue from their aggressive neighbors, and are going to swallow their prejudice or indifference and get to spraying. I have not yet found a single orchard in which there was no scale, although in some instances the owner was under the delusion that he was clear of it. Ninety per cent. of the trees, in general, are infested.

The boiled lime-sulfur is the most efficient remedy for the suppression of San José scale. A direct question put to one of the strongest advocates of oil in the county, as to why he did not use oil exclusively, brought forth this characteristic reply, "Well, the lime-sulfur wash has merits that the other stuff does not have." Spring spraying, as late as the conditions of the trees will warrant, give the best results. The chief reason why lime-sulfur is not uniformly successful is in the boiling; forty-five minutes is not enough, as it should boil not less than one hour, where fire is used; and where steam is used, it should boil even longer. I have made careful comparisons and can submit data to prove the claim. [I certainly agree with Inspector Bowers on this very important point.—H. A. S.]

Scalecide was used in Franklin county a few years ago extensively, with decidedly poor results. Where the one to twenty formula was used it failed to control the scale, and where a stronger formula was used it would kill the scale and injure the terminals of the branches, and often very seriously injure the fruit buds. Target brand, used one to sixteen, gave fairly good results on apple and pear; but it is injurious to peach and plum, especially when used strong enough to kill scale.

The Bud moth, or Bud borer, was quite destructive in some localities, and although I received instructions from headquarters to take all time necessary to work on the case, I failed to find the larva, owing to the lateness of the season. Borers in apple and peach are always to be reckoned with the knife and a wire are the remedies. Collar rot or Root rot on apple is becoming alarming through the Cumberland Valley. Three parts quick lime and one part sulfur has been recommended as a remedy. Peach yellows is prevalent everywhere, causing thousands of dollars loss each year. No remedy.

Many persons who looked with suspicion and distrust upon the work in the beginning have seen what has been accomplished, and have become its warmest supporters. Of course, there are still a few who insist in chopping off their nose to spite their face, but they are the exceptions.

The inspector, as a rule, is received courteously. Often his coming is anxiously awaited; a few suggestions, a little advice, and then, if it happens to be anywhere near dinner or supper time, he is "O. K."

Generally speaking, the advice of the inspector is appreciated and followed, and very often it is sought by persons who have made orcharding not only a business but a success.

The outlook for fruit growing is promising. Not only are many fruit trees being planted on a small scale, but also on a large basis, due to the fact that the wide-awake grower has not been slow to adopt the methods prescribed by the Chief under whom we serve. These are the methods that have for four years withstood every onslaught of their enemies, and, like a conquering army, are carrying everything before them, and even their enemies sing their praises.

Some of the most successful growers in Franklin county are the following: G. J. Rawhauser, Greencastle, thirty-six acres of apples. This crop was sold in bulk at a good price. Mr. W. H. Wishard, Chambersburg, R. D. 9, has six hundred bearing apple trees, including many just beginning to bear, and he sold four hundred and eighty barrels of apples at two dollars and twenty-five cents per barrel. In addition to the bearing trees, Mr. Wishard has five thousand young apple trees and one thousand peach trees, and he is going to plant many more. Edgar A. Nicodemus, Waynesboro, R. 2, has one hundred and sixty-two acres in apples,—one hundred and forty acres in bearing. The crop was estimated at seven thousand barrels. This crop was sold for three dollars and fifty cents per barrel, f. o. b. cars, size of each apple to be not less than two and one-half inches in diameter. Mr. D. M. Wertz, Waynesboro, has one orchard at Quincy with forty-two hundred apple trees (twenty hundred young, twenty-two hundred bearing), and thirty-three hundred peach trees (eighteen hundred young, fifteen hundred bearing, with another orchard at Mont Alto with fifty-two hundred apple trees, thirty-six hundred young, sixteen hundred bearing, and sixteen thousand four hundred and fifty peach trees, two hundred young and sixteen thousand two hundred and fifty bearing). Mr. Wertz shipped seventy carloads of peaches this year, and one hundred and thirty-five carloads last year. J. H. Ledy, Marion, with his orchard adjoining Mr. Wertz's at Mont Alto, has eight thousand seven hundred apples trees, six hundred pear, eight hundred plum, and sixteen thousand two hundred and fifty peach trees. Mr. Ledy expected to ship thirty carloads of peaches. Philip Bickle, Chambersburg, R. D. No. 12, the most practical peach grower in the county, has five hundred and forty apple and eight thousand two hundred peach trees. Mr. Bickle expected to ship twenty carloads of peaches.

Mr. Chas. O. Bonner, Chambersburg, R. 10, has five thousand three hundred peach trees, with a good showing of apples, plums and cherries. Mr. Bonner is the only person I ever met who does not sell prematurely ripe peaches. He destroys the fruit along with the trees.

J. L. Reed & Co., Chambersburg, has five thousand apple and ten thousand peach trees. Jno. H. Good, Mont Alto, R. 1, has seven hundred and fifty apple and one thousand seven hundred peach trees. Mr. Good sprayed with Target Brand, and while his apple crop was good, his peach crop was ruined.

One hundred per cent. more trees are being planted now than four years ago. First, because people were taught how to care for them; and second, the profits realized are far above any other product of the soil.

Unfortunately, there is very little co-operation among the farmers and fruit growers. Each one seems to be doing the best he can for himself. The reason for this, I think, is that the beneficial results accruing from co-operation have not been clearly explained to the growers, hence they do not appreciate what it would mean for them.

The result of suspending the work at the present time would be equivalent to brushing away with one stroke the confidence that it took four years to establish, and give the knockers the chance to say, "I told you so."

Each inspector should be stationed in a permanent district: For example, I receive requests for service from residents of Lehigh, or the northern district of Lancaster. I am working in Franklin, and not in a position to respond. Time does not allow it, neither does the salary. It is simply a case of sowing good seed, then allowing the tares to choke it. Inspectors should not only be posted on insects, but should have a good knowledge of the varieties of fruits best adapted to the locality in which they are working, the soil in which the varieties should be planted, the preparation of the soil, and the starting of an orchard.

REPORTS OF PENNSYLVANIA ORCHARD INSPECTORS.

CHESTER COUNTY.

Inspector, FRANCIS WINDLE, *West Chester, Pa.*

There are very few orchards in Chester county entirely free from the San José scale; about 99 per cent. of them are infested, but varying greatly in the degree of infestation in different sections. Many full grown apple orchards are not injured, possibly owing to local enemies of the scale. [Very old trees, with slow growth and thick bark, are often not so badly injured.—H. A. S.]

There is a continuous spreading of the scale on the young orchards, and young trees are being destroyed, but I am inclined to think that there is a little check on the general increase.

In the sections where I have inspected this year there has not been much spraying done. The materials mostly used were boiled lime and sulfur. I have not observed any difference in results according to dates of spraying. The results generally correspond to the degree of thoroughness of the work. Where the spraying was thoroughly done, according to the State Zoologist's directions, the lime-sulfur wash has been successful.

Scalecide and other oil preparations have been used by some. No injury to trees observed this season. Mr. Alexander South, of Oxford, had considerable injury to peach trees from the use of Scalecide last year.

I have not the information that would enable me to say that any particular remedy, used in this section, was insufficient, or unable to control the San José scale.

The scurfy bark scale has in some instances been destructive to young apple and pear trees, and species of aphids or plant lice were present in injurious numbers on Norway maple, sweet cherry, occasional plum, young apple (both woolly and green aphis), and currant bushes. The peach and apple borers and the Bronze Birch borer have been damaging in some localities. The Codling moth and plum curculio have been very harmful to the apple crop,

Samuel L. Brinton reported injury to his strawberries from the White Grub, and nurseries have suffered great loss therefrom the past summer. [The White Grub has been unusually bad in many parts of the State.—H. A. S.]

A few people are realizing the importance of spraying their fruit trees with arsenate of lead, for the Codling moth worm and the curculio. Samuel L. Brinton, near West Chester, had excellent results from such spraying, the past season.

There is considerable interest manifested in the inspection and demonstration work. Considering that the demonstration orchard at the County Home is unfavorably located, as to railroads or trolley lines, the attendance at most of the meetings held there has been reasonably good. The best evidence of the interest people have in the work is the number of inquiries addressed to the Inspector, and requests to visit them for some special inspection.

The Inspector is almost universally well received. The apparent willingness of many people to follow his directions is not always supported by action. Their failure to carry out instructions is generally explained by lack of time and help, or that they do not think it will pay them to get an outfit and spend the time necessary to accomplish the end desired. There is, however, an apparent demand for professional sprayers, many say they would like to have their trees sprayed if they could get some one to do it at reasonable cost, etc.

A few farmers make a partial business of fruit growing, and attend to their trees, others with but the ordinary farm orchard have realized the necessity of spraying, and other attentions, and are practising the methods taught them, with good results.

Orchard planting still goes on—though some are discouraged on account of the scale. All realize that there is no use to plant unless the trees are cared for, and the fact of their planting in the face of these conditions, is encouraging for better orcharding in Chester county.

There is too little commercial fruit growing here, as a special business, to make co-operation between farmers and fruit growers much thought of.

The people are beginning to look upon the Inspector as a necessary helper, and the suspension of the inspection and demonstration work would be a misfortune, just when the results of the battle made are beginning to look good.

I think the service might be improved by giving more attention to individuals who are desirous of planting or improving their orchards, by direct help in pruning and spraying, where the orchards warrant it, as a means of encouragement, as well as instruction.

Some good work might be done through the public schools, by properly regulated visits of the Inspector, in co-operation with the County Superintendent, to illustrate to teacher and pupils, the character of the San José scale,—how to know it,—as well as other scale insects, and how to treat trees and plants infested by them. This line of work was suggested by Superintendent Moore, at the late County Teachers' Institute, and so far as observed, met with favor.

DELAWARE COUNTY.

Inspector, M. E. SHAY, Holmesburg, Pa.

Mr. Shay's counties: Delaware and Philadelphia.

In Philadelphia and Delaware counties the work of inspection and demonstration was carried forward, and about 25,000 trees were inspected in Delaware county alone. I can safely say that there are very few places which I have inspected where I did not find San José scale, but I am at the same time pleased to state that the farmer is becoming more interested and anxious to get rid of this pest. He makes every effort to obtain and follow instructions, and always receives me with kindness and evidences of pleasure.

There is great improvement to be seen in the Demonstration Orchard at the Delaware County Home, and much interest has been taken in this subject. Some of the trees were so badly infested with San José scale when we undertook the work that it was barely possible to save them. Many were also injured by scurfy scale. All of them are now beginning to show the results of our work and what can really be done by proper methods. If this is continued it will show practically yet greater improvements in the near future.

There is much satisfaction in the fact that people are buying spraying machines, and making their own boiled Lime-sulfur solution, and always agree to secure all information they can upon the subject of the modern methods of pest suppression. Whereas they were but a few years ago, greatly discouraged by the ravages of the deadly San José scale, they are now planting many new fruit trees, without fear of loss from this pest, as they now feel that if they want perfect fruit all that is necessary is to plant the trees and care for them properly. They realize that they must spray.

I find all kinds of scale destroyers and proprietary insecticides used, but many have met with only poor results. Where the Lime-sulfur solution was used good results are observed, when the spraying was properly done and the material was used at sufficient strength.

Some people seem to think that the San José scale is dying out, but if they would travel with me for a few days I could prove to them that it is becoming more numerous and destructive in those orchards, or upon those trees, that are being neglected. On the other hand, where the trees have been sprayed it is dying out, but this is by virtue of the proper application of remedies, rather than by any natural causes.

I hope the Demonstration Orchards will be continued, as these become the practical means of definitely teaching the agricultural people, and convince them that there is hope for fruitfulness in a region that was rapidly becoming practically barren, as far as fruit-production is concerned.

One important feature of the work of the Inspector in Philadelphia county has been the inspection of estates, or beautiful resident premises, where there was much ornamental shrubbery. A great deal

of this, especially of certain kinds, such as Osage Orange, Japan Quince, Mountain Ash, Purple Plum, ornamental variations of the fruit trees, currants, etc., were almost uniformly found to be badly infested with San José scale, and the Linden, Ash, Poplar, Soft Maple, and a few other trees, were often found badly infested with oyster shell scale. Where the persons in charge of such premises followed the advice given, either by me directly, or through the office of the Division of Zoology, they have in almost all cases obtained good and satisfactory results in the destruction of such pests, and in the preservation and restoration of the vigor and beauty of their ornamental plantings, as well as of their fruit trees.

Since the results of this work are now becoming so apparent many persons are becoming quite enthusiastic in recognition of the services thus being rendered and are planting more trees and shrubbery than ever before.

HUNTINGDON COUNTY.

Inspector, JAMES BERGY, Mifflintown, Pa.

Mr. Bergy's counties: Clearfield, Huntingdon, Juniata and Mifflin.

In Huntingdon county the orchards generally are not so badly infested with the San José scale, but in and about the boroughs of Huntingdon and Mt. Union, the village of Mill Creek, and in Henderson township trees and orchards are badly affected. In the other districts of the county the conditions are not so serious, but the scale is spreading, and energetic work will be required to keep it in check. Some spraying is being done, and where this is the case the scale is not spreading so rapidly. Many of the orchards in this county are sadly neglected and greatly need proper pruning and cultivation. The neglected trees are affected to a considerable extent with scurfy scale, oyster shell scale, codling moth, woolly aphid, frog-eye fungus, and other plant diseases.

There is a demonstration orchard at the Reformatory farm at Huntingdon, and the farmers and fruit growers have been much interested in the demonstrations held at that place; but the county is large, and many of those deeply interested in this work were unable to attend these demonstrations. There should be two or three more demonstration orchards in this county.

In none of the counties of the district are the farmers and fruit growers organized to co-operate with each other along this line of work, or to otherwise advance their interests in this direction.

JUNIATA COUNTY.

Inspector, JAMES BERGY, *Mifflintown, Pa.*

Mr. Bergy's counties: Clearfield, Huntingdon, Juniata and Mifflin.

The inspection of the orchards of Juniata county was completed in 1908. About sixty per cent. of the orchards were found to be more or less infested with the San José scale at that time, but the greater number of orchards so affected were east of the Juniata river. Many of the peach and plum trees had already been killed and many of the apple orchards were in bad condition. West of the Juniata River the orchards were but slightly affected, but since the inspection was finished the scale has been spreading rapidly. Many orchards have been sprayed with the lime-sulfur solution, and where thoroughly boiled and properly applied the result has been satisfactory.

The planting of fruit trees in this county is on the increase. Many peach, plum and apple trees have been planted within the last two years, and many new trees have been ordered for planting next spring. The growing of fruit, especially apples for shipping, is on the increase.

LANCASTER COUNTY.

(See Inspector Herr's Report for Adams County and Inspector Bowers' Report for Franklin County.)

LAWRENCE COUNTY.

Inspector, J. W. COX, *New Wilmington, Pa.*

Mr. Cox's counties: Lawrence and Mercer.

Many of the orchards in Mercer and Lawrence counties have been neglected for many years, their owners taking no interest whatever

There are some orchards planted within the last thirty years that have received some attention and are fairly productive, but it requires only a glance to see that the owners do not understand horticulture. Occasionally I find an orchard that has been planted and cared for with the intention of making it profitable, and the owners of such orchards inform me that the profits are very satisfactory.

There is not much San José scale in my district. Some trees are badly infested, but only a few have died as a result of the scale infestation. I can not say whether the scale is increasing or decreasing. In localities where I have inspected, and held spraying demonstrations, I know that some have been successfully spraying for the scale.

I have not inspected one orchard this season that has been sprayed for the San José scale. Very few owners knew that their trees were infested until I made the inspection. About fifteen per cent. of the orchards inspected are infested with San José scale.

About twenty per cent. of the trees in the infested orchards are infested. Often the infestation appears to be confined to a few small trees, recently purchased from a nursery.

The lime-sulfur wash has been the most efficient spray used. The owner of an orchard, where I held a spraying demonstration two years ago, told me recently that the peach trees sprayed at the demonstration, produced much more and larger fruit this year than the unsprayed trees did. I have not had an opportunity to compare trees sprayed at different dates.

I have not seen an orchard in Western Pennsylvania sprayed (for scale) with any other material than the lime-sulfur wash, during the past year.

The canker worm has been doing much damage to many of the orchards in my district. Orchards have been defoliated for several years in succession, and many of the trees are dead and others are so seriously damaged that they are practically worthless. Spraying with an arsenical spray, either Paris green or arsenate of lead, has proven very satisfactory. The Codling moth has seriously injured the apple crop, but, with very few exceptions, has not been treated with spray.

The public is becoming more interested in the inspection and demonstration work each year, and many inquiries are received regarding the treatment for different insect pests. Many farmers are making inquiries regarding the proper kind of a spraying outfit for their orchards. Some say they expect to get an outfit, but know nothing about the different makes, or the kind that would be best suited for their orchards.

As a rule where the farmers have any interest whatever in their orchards they are pleased to have the Inspector call and inspect their trees, and give information regarding the treatment of them.

The growers appear willing to follow directions, but I fear that many of the orchards will be neglected in the future, as they have been in the past.

The outlook for orcharding in my district is not very promising under present conditions. The farmers, with a few exceptions, do not have a sufficient knowledge of horticulture to properly care for their trees. I find them less competent for that work than for any other branch of agriculture. They have never had much opportunity

to learn, but they have commenced to realize that something must be done to protect their trees from insects, and are pleased to know that there is a source from which they can get information.

The Zoological Bulletin and Weekly Press Bulletins are very much appreciated, and I think will be a great help to all who read them.

As my territory comprises about one hundred and fifty square miles, I find all sorts of conditions existing, and I frequently have the pleasure of inspecting some fine orchards that have been well-cared for and are yielding their owners very handsome profits.

I think that if our work is continued, a very much better report of the conditions in Western Pennsylvania can be made in a few years than at present.

As successful orchardists, I will refer to Mr. J. B. Johnston, who owns several large apple orchards near New Wilmington. By properly caring for his trees, Mr. Johnston is able to secure profitable crops of fruit every year.

Another successful orchardist is Mr. S. H. Huey, a bricklayer and contractor, who owns about three thousand fruit trees, consisting of apple, peach, pear, plum and cherry, located about three miles north of New Castle. Mr. Huey purchased about thirty acres of land that was not producing profitable farm crops, planted twenty-three acres in fruit trees, and at present has an orchard that is yielding him a handsome profit. Orchard planting is on the increase, and I think that with a better knowledge of the subject there will be more interest taken.

The farmers and fruit growers are co-operating to the extent that they are pleased to have their trees inspected, and in many cases are acting upon the suggestions made by the inspector.

LEBANON COUNTY.

(See Inspector Fertig's Report for Carbon County.)

LUZERNE COUNTY.

Inspector, D. A. KNUPPENBURG, Lake Carey, Pa.

Mr. Knuppenburg's counties: Bradford and Luzerne.

The third was sprayed with the lime-sulfur solution in April, and also, with Bordeaux and arsenate of lead on May 29th. The fourth was given the same treatment as the third, with additional spraying of Bordeaux and arsenate of lead June 12th. On August 9th some wormy apples were picked from these trees and thrown away as follows:

From the first 348, from the second 103, from the third 36, and from the fourth only 8. On October 20th, the wormy wind falls, or dropped apples, were found to be as follows: From the first 135, from the second 115, from the third 62, and from the fourth 50. On examining a few apples on the trees on August 20th, the percentage of wormy apples picked was found to be as follows: From the first 11 per cent., from the second 14½ per cent., from the third 3 per cent., and from the fourth 4 per cent. In summing up the total percentage of wormy apples produced, including those lost in the process of thinning, those dropping prematurely and those picked, the relation to the sound apples was found on tree No. 1 to be 42 per cent. wormy; on tree No. 2, 35 per cent.; on tree No. 3, 10 per cent.; and on tree No. 4, 11 per cent.

Mr. Lewis produced one of the very finest crops of fruit ever seen in Pennsylvania in that large portion of his orchard which we did not take for demonstration purposes, and in which we had no part whatever. The fact that he practiced methods advocated by us is to his credit, and he is more than satisfied with the financial result as well as the pleasure that comes in producing a large crop of absolutely perfect fruit. His exhibit from this orchard, shown at the recent State Horticultural Association meeting at Tunkhannock, would have done great credit to any American fruit grower. His boxes of fruits were far superior to those from the far west, which were exhibited side by side with his Northern Spies and Sutton Beauties. It is gratifying to know that the demonstration orchard work is bringing such conspicuously good results in such a short time.

MERCER COUNTY.

(See Inspector Cox's Report for Lawrence County.)

MIFFLIN COUNTY.

Inspector, JAMES BERGY, Mifflintown, Pa.

Mr. Bergy's counties: Clearfield, Huntingdon, Juniata and Mifflin.

About one-half the orchards in Mifflin county are infested with the San José scale. In some orchards only a few trees are as yet affected, but in the northeastern part of the county some of the bearing apple trees are so seriously affected that it will be almost impossible to save them.

In 1908 the Department took charge of the orchard on the county farm at Lewistown for a demonstration orchard. A number of demonstrations in spraying, pruning, fertilizing and cultivation were held at this place. They were well attended, and great interest was shown in the work. Many people still visit this orchard to see for themselves the results of the work done there.

There are but few orchards in this county where fruit is grown for commercial purposes. Most of the fruit is grown for home consumption. However, a great many young trees are being planted to replace old ones which have died off and new orchards of from twenty-five to fifty trees are being started.

The work of the last year has further demonstrated the necessity for, and the beneficial results of a systematic and energetic warfare upon the San José scale and other scale insects and other insects which infest and injure fruit trees in this district. Where spraying has been done with the proper kind of material, and in a proper manner, the beneficial effects of the work become at once apparent, and the farmers and fruit growers in the several counties of the district are realizing more and more the beneficial effects of the work that is being done by the Department of Agriculture and especially by the Division of Zoology, in their behalf in this particular direction. They are taking much more interest in the work than they did two years ago and are doing more to help themselves. More of them are spraying their orchards and fruit trees or having them sprayed, and more interest is being taken in the pruning of the trees and the proper fertilization and cultivation of the orchards. While the results already obtained have been very considerable indeed, yet if the benefit of these results are to be enjoyed this work must be continued for the people to be benefited have not as yet arrived at anything like a full realization of the condition which confronts them, or the danger which threatens them in the loss of their fruit trees. The scale insects are still here and hard at their destructive work, and if the ravages of the pests are to be overcome, and the fruit trees of the district and State at large saved from destruction, this work should be continued as energetically in the future as it has been in the past; and surely the beneficial results to be obtained from the work fully justify its being continued.

While in those parts of the district in which spraying has been done, and where the farmers and fruit growers are close enough to the demonstration orchards to be able to observe the beneficial results of the work done in them, the interest taken in the work is naturally more pronounced and the efforts of the people to help themselves and save their trees is greater, yet even in the remoter districts they are awaking more fully to the danger of the loss of their fruit trees and are making more of an effort to save them. I am of the opinion that more demonstrations should be held and the work along that line continued for the present. If possible, the places for these demonstrations should be selected in the parts of the several counties which are infested with the scale, or into which it is spreading, where such demonstrations have not been held in the past.

The people as a general thing receive the visits of the Inspector cordially, and in many cases gladly, and assist him in every way they can. Numerous requests for demonstrations have been received from different parts of the district.

The material most generally used by the people who have sprayed trees for San José and other scale insects has been chiefly home-boiled lime and sulfur, and where the mixture has been thoroughly boiled and properly applied the result has generally been very beneficial and satisfactory. There have been some cases where the result did not seem to be satisfactory, but an investigation showed that the mixture had not been boiled or applied according to directions. Some commercial lime and sulfur has been used, and when properly applied (strong enough) it also has been found to secure satisfactory results. I find this to be the case with Orchard Brand of lime and sulfur solution.

Some oils were used for spraying for San José scale in proportion of 1 to 15, and while they killed some of the scale, they at the same time injured many of the trees. In one case in particular, in Mifflin county, I found a dwarf pear tree which had been sprayed with an oil solution, and while I found some of the scale had been killed, I also found that the bark of the tree had been injured.

So far as I have been able to determine from my observation during the last two years the boiled lime and sulfur solution is the most effective material for destroying the San José scale, oyster shell and scurfy scale. For the codling moth, woolly aphis, tent caterpillar and fall web worm, I find spraying with Bordeaux mixture and arsenate of lead to produce satisfactory results, if the spraying is done at the proper time.

I also find that the apple tree borer is doing considerable injury to the apple, pear and quince trees in some parts of the district. This can be prevented by cutting them out with a sharp knife and then painting the trunk of the tree for a distance of 18 inches from the ground with white lead and raw linseed oil in the month of June.

As the scale seems to be spreading into parts of the district not yet infested I would advise that inspections be continued in that part of the territory, and that demonstrations be held in those parts of the counties in which they have not yet been held. These demonstrations should be held at points not too far distant from each other, so that a larger number of the people can attend them, and find out what their trouble is and how to make and apply the remedy.

MONTGOMERY COUNTY.

Inspector, J. S. BRIGGS, Norristown, Pa.

On the other hand, those who have been applying remedies are frank to say it is decreasing. Some have gone so far as to say: "They do not concern themselves about the scale; they have it under control and can now keep it there."

I would say about 95 per cent. of our orchards are infested, and about one-third of the trees in general; very rarely do I find all the trees infested.

Lime and sulfur when properly prepared has proven the most efficient remedy. I have not observed any material difference as to the effect in the time of spraying, except perhaps in very cold weather, when I am led to believe it is not so effective. When the lime and sulfur wash has not come up to our expectations or desires, we have been more careful to learn why not, and almost invariably discover that it was improperly made, many times not boiled, or carelessly applied.

Next, as to insufficient remedies, there are a number of instances in which Target Brand has proven injurious to peach trees in Montgomery county, and still others when no appreciable results have been observed.

In the early spring of 1907 the local newspapers passed around, so to speak, the story of the wonderful power of carbolic acid to control the scale. My mail contained many papers with this article on the carbolic acid treatment marked, and letters were sent me asking my opinion as to its value.

I got one of our commercial sprayers to write to Prof. John B. Smith, of New Jersey, whence this notable discovery, it was assumed, was made. The answer came back: "It will not be heard of after it has made its rounds in the newspapers; stick to your lime and sulfur." And true enough it is seldom mentioned now. I can not recall a single instance where it has been applied recently. Prof. Surface also condemned it from the first. Some few have tried headlight oil, together with soap and water, and have produced definite results—the scale was killed—they died with the trees. One man tried, under instructions from "they say," one pound of soap and one quart of kerosene in 100 gallons of water. He killed nothing save time.

One man came to Norristown last winter and announced himself as Prof. Wesley, of Brooklyn, entomologist and pomologist, and claimed there was scale on all our ornamental trees in the streets. He got a number of jobs and sprayed something on the trunks of the trees to a height of about four feet. (Instance at Ross.) Finally he was told to see Mr. Briggs on Powell street, and get his endorsement, and he would have plenty to do. He never made the call. Some of his customers began a search for him, and he skipped the town rather suddenly.

I mention these facts to show that people are interested and wish to save their trees.

One of our serious troubles at present arises from the neglect to prevent loss from the attack of the codling moth. I believe I am not overestimating its work or presence when I say that nine out of ten apple orchards are more or less affected by it. It should be controlled by arsenical spraying just after the blossoms fall.

It affords me pleasure to say that the public is becoming deeply interested in our work. A prominent orchardist this summer said to me that when we first entered the field, "Many smiled and said: 'This will last only a little while and that will be all there is of it.' Now we realize that your service has been a great help to us and we want more of it." Now pardon me for saying no man could expect to be better received than I have been during the last two years, and my suggestions have been given due consideration. One man cut down last summer 44 peach trees in an orchard of 400 trees the day after my visit. So said his father-in-law, whom I met on a trolley car a few days later. (This was for yellows, and was consequently correct. H. A. S.)

I am positive that there never has been such an interest in fruit growing in Montgomery county as exists at the present time, and that interest has been growing steadily. More spraying will be done than ever has been done. We know this from the fact that those who have taken to it are keeping it up, and the list is increasing each season. More trees will be planted than in any former season.

We began our work in this county April 12th, 1906, and during this period of time we have given 49 public demonstrations of spraying and 46 public addresses, previously announced in the local papers, on the life, habits and treatment of insects affecting our fruit trees, and on the care of our orchards.

We have organized an association known as the Fruit Growers' and Market Gardeners' Association of Montgomery County, Pa. The first meeting for conference and exhibit of fruit, etc., was held on the 29th of September last. Time does not allow me to speak of this meeting in detail. We have 87 members, and others are sending their names each week asking for membership. This association will accomplish a great deal of good and prove an incentive to the producers.

As to the suspension of our work in the county, I have this to say: This department, as well as that of the Governor's will be deluged with letters to have it resumed or continued. And now as to the improvement in the service, may I say the Chief of the office understands the needs of our work in general better more than any one else, and each individual ought to know and may know more about his particular field than any other.

In conclusion I wish to mention some of the more prominent fruit growers:

John C. Saylor, Pottstown, R. F. D. No. 5, Pa., 5,000 trees.

A. R. Tyson, Norristown, R. F. D. No. 1, Pa., 2,000 trees.

Robert Dyson, Trooper, Pa., 800 trees.

Michael Bros., Norristown, R. F. D. No. 3, Pa., 2,000 trees.

Smith & Wright, Spring City, Pa., 4,500 trees.

Olvin Haines, Norristown, Pa., 2,000 trees.

R. G. Brooke, Schwenkville, R. F. D. No. 2, Pa., 1,500 trees.

George Moyer, Schwenkville, R. F. D. No. 2, Pa., 1,000 trees.

NORTHUMBERLAND COUNTY (AND UPPER DAUPHIN).

Inspector, D. B. MURRAY, Liverpool, Pa.

In most of the territory inspected last year, generally, I found the orchard conditions bad. The soil was not fertilized nor was it cultivated, with the result that the trees were often dying from starvation. The farmer too frequently left the trees to grow at will and random. Where any pruning was done it often showed evidence of either ignorance or carelessness. Spraying for San José scale, the codling moth, and fungus diseases were generally not thought of, and the fruit showed the result.

I have spoken above in general terms; not all farmers having acted so indifferently; some have pruned, fed the soil, and made some pretense at spraying.

The San José scale in upper Dauphin county is spreading over a wide area, and is rapidly increasing; this is especially true in those orchards which have had no care. Ninety per cent. of the orchards I have inspected have scale, and from 60 to 75 per cent. of the trees are infested. It is a great satisfaction, however, while in the midst of destruction to know that the scale can be controlled and even exterminated. There is no question that where the L-S has been properly prepared and applied the scale has been killed. The trouble has been in preparing it; some have simply put sulphur with whitewash, found on good results, and have from that condemned the L-S formula.

I have found a great number of orchards which have been sprayed with one of the oils; in two instances the trees were killed; in another orchard about one-third of the trees were living and covered with scale, while the balance of the trees were dead. In another case, that of Mr. Albert Boyer, teller in the Lykens Valley Bank at Elizabethville, who has spent a great deal of money to protect his trees with indifferent result. Just what brand of oil he used I do not know.

Besides the San José scale I found the oyster shell scale in abundance on the lilac, and frequently on the apple, but in only two instances did I find it in sufficient numbers to be destructive to fruit trees; these trees had not been sprayed. I found also the woolly aphid, and the apple and cherry aphid in great numbers, the codling moth, and the peach lecanium. Where the trees were sprayed for the codling moth, using the Bordeaux mixture with arsenate of lead, I found the fruit in good condition, while the foliage was comparatively free from disease spots.

I have confidence in the general public, and believe that it is awaking to the fact that intelligent care of trees is essential if they wish to reap a profit. Night after night, I have sought out the most influential men,—farmers who were looked up to by their fellows; and have talked with them and to them until they thought as I did; then I turned them over to the office, and I think Dr. Surface

can show you that their subsequent inquiries were not few. Show the farmer a way out of the difficulty, and my word for it, they will act. Some are "from Missouri," but even they can be shown.

A great number of young trees will be planted in the spring; I believe I am not placing the estimate too high when I say that the number will go up into the six figures or reach over 100,000. This will not be due wholly to the inspector's work, but largely through the assiduous work of the Chief, Dr. Surface.

Mr. Landis, of Harrisburg, owns three or four large farms in the upper part of the county, on which he has planted trees aggregating 8,000. He has given these trees intelligent care. Mr. Landis oversees the work personally, with the result that he is realizing nice returns from his young trees.

Wilson Boyer, from less than 550 peach trees, sold nearly \$800.00 worth of fruit this fall. These men did not go into the business for fun, but as a hard business proposition. They are winning out, because they are using up-to-date methods and are not backward about writing the office when they want information. What makes one's heart warm toward men of this stamp is that they are willing to give credit to the source where it belongs.

Just what the result would be if the inspection work was stopped now I do not know; I believe there would be an awful protestation sent up by the farmers. I addressed 20 representative men along this line, and received replies from every one. The answers were all to the effect that it would be a great calamity.

I am of the opinion that the best interests of the service demand that there be more demonstration work; men will watch that work, see the results, and go home and do likewise. Another feature which could be improved on is the blank form of the Inspectors' reports; if these could be put in such a form as to leave a stub for the Inspector's personal information, I believe it would systematize his work, and be the means of gathering important data which otherwise is lost.

PERRY COUNTY.

Inspector, T. C. FOSTER, Winfield, Pa.

Mr. Foster's counties: Centre, Perry, Snyder and Union.

The San José scale infestation of Perry county, where the work of inspection was completed in the month of August in this year, showed that about 30 per cent. of the orchards and about 10 per cent. of the trees, on an average, were infested. The organization of a County Fruit Growers' Association has greatly assisted in the creating of considerable activity in the work of spraying for the control of the San José scale. Fully fifteen new spraying outfits were started last spring, assistance being furnished free by the Division of Zoology through their representative to all who made application for the service, and an additional number are expected to get in the procession this fall. The lime-sulfur wash, both commercial and home-made, has been used almost exclusively, and is giving almost entire satisfaction whenever applied thoroughly. There have been better results ob-

tained generally from spring spraying rather than fall. A few persons reported that they did not have the success with lime-sulfur that they had anticipated, which was due to poor equipment, weather conditions, etc. Few remedies, aside from the lime-sulfur wash, have been used in the county for scale; Target Brand Scale Destroyer and Scalecide in a few instances being tried experimentally, but those doing so regarded these preparations as too expensive, as well as not proving satisfactory.

Other serious insects found were Codling moth, curculio, borers and aphids, while in a few instances, the scurfy and oyster shell scales were found to an alarming degree. The remedies used and prescribed for the Codling moth and curculio were either arsenate of lead or Paris green, which proved quite successful in controlling the pests. Aphids, oyster shell and scurfy scale were easily dispatched, if taken in time, by spraying with Whale Oil Soap, home-made soap or Kerosene Emulsion, as recommended in the Monthly Bulletins.

There seems now less interest taken in the Demonstration Orchard in the county, and more in the application of the principles (along the line we have been working) to the owner's orchard. One other reason for lack of interest in the County Orchard is explained by the difficulty in reaching it, being located in a section of the county having poor railroad accommodations. In the majority of cases the Inspector has been received respectfully, after stating the object of his visit. The growers are becoming more interested, and show a greater inclination to follow directions in orchard care.

Orcharding in Perry county is advancing, and is being given considerable impetus since the formation of a fruit growers' society. Mr. F. P. Duncan, of Duncannon, until recently the owner of a farm about three miles from that place, claimed that his orchards were the means of producing a ten per cent. interest on money invested in the property. Several others have good paying orchards, and the indications look favorable to the establishment of a number of commercial plantings. The organization of the Perry County Fruit Growers' Association last February has proved a help to its members in the purchase of spraying materials, and it is now the intention to enlarge the benefits to be derived through the means at their command.

PHILADELPHIA COUNTY.

(See Inspector Shay's Report for Delaware County.)

dreaded scale on two premises. Such limitations in its spread I attribute mainly to the fact that nearly all the orchards were planted before San José scale was imported into this country, and to the very limited setting of orchards since its arrival.

But, inasmuch as there is very little San José scale present in this county, we have a fitting substitute in our ever present and increasing oyster shell scale. This scale I find present in greater or less quantities in every orchard, and 99 out of every 100 trees are infested. From its dormant attitude one would judge it to be very harmless, but when the increased vigor and healthfulness of the trees, as well as the fruit, are demonstrated after being sprayed with lime-sulfur wash, there is left no room for doubt as to the destructiveness of this scale insect. I have found many cases where oyster shell scale is partly controlled by scrubbing the trunks and limbs in June with hardwood ash lye, in the proportion of four to six quarts of lye to twelve quarts of water.

Lime-sulfur wash, from the results obtained in the demonstration orchard and individual demonstrations, is the cheapest, safest, and most efficient material with which to control oyster shell scale. Putnam's scale, which I find on the trunks of about two-thirds of the apple orchards, and also on plum trees, closely resembles the San José scale in shape, but not in color, nor in its injurious effects and rate of multiplication. This scale readily succumbs to the "pleasant touch" and "odor" of lime-sulfur wash.

Borers and unprincipled nursery agents seem to work hand in hand in this section. The fruit tree agent delivers trees not exactly according to the attached label; and, forthwith, the generous borers girdle the tree, in many instances removing any doubt in the mind of the owner as to the veracity of the fruit-tree agents.

Coal ashes and paint are used as means for circumventing the borers, and, I might say in regard to the cases of the painted young trees, where I found borers, that the trees were painted after being set. The ground was not removed, as it should have been, and the trunks were not painted down in the ground for a couple of inches, and it was here that I found the borers.

Around young trees wrapped with veneer and tar paper I have found borers, but to only a limited extent. Nevertheless, it proves even though a young orchard be wrapped when set, the trees will need some further attention, as the tarred paper does not always do the work.

I have found that Carbolineum Avenarius, mixed in a naphtha soap emulsion, and applied to the trunks of plum and cherry trees, so far seems to be quite efficient. I have found numerous cases of where the owners learned of Carbon bisulfide through Professor Surface, and where the holes could be readily reached they have successfully used that remedy. For borers, prevent them by painting the trunks with raw linseed oil and white lead, but after they are present kill them.

Plant lice this last season were particularly plentiful and injurious. I found no one successfully controlling them.

Leaf mite galls (the leaf blister mite), especially in uncultivated and unfertilized orchards, during dry seasons, are much worse than where the trees are in good soil conditions. Lime-sulfur wash in the demonstration orchard, applied in the Spring, controlled this pest.

Codling moth, due to its unrestricted ravages, causes a greater financial loss than all other insects combined. Arsenate of lead, two to three pounds to fifty gallons of water, applied when the petals have just fallen, and again in August for the second brood, has proven very successful,—as high as 90 to 95 per cent. of apples free from worms resulting. Paris green, applied at the rate of 6 to 8 ounces to 50 gallons, has brought about fair results.

Good interest has been shown in the demonstration work in my district, not only by the farmers, but by the public in general. That it has interested them is proven by citing that there were nearly a dozen men who sprayed their orchards within a radius of about three miles from the demonstration orchard, without mentioning the others living elsewhere in my county. The inspection work arouses a certain amount of interest in those men, especially, who have been getting and reading the bulletins. Others are awakened to their conditions and possibilities, after going through their orchards with the Inspector, having the insects and orchard defects pointed out and their means of control and improvement explained. The chief reason for lack of interest in the inspection work in the northern counties is the scarcity of San José scale. But when it comes to pruning and spraying, they "sit up and take notice." Even the fair results of spraying this year, in the presence of aphis, chalcids and drouth, are going to set a ball rolling that will soon be gigantic in power and size in such a well adapted winter-apple region as this.

In Tioga county, since the location of a Demonstration Orchard and the widely known results of last year, I have been taken, during inspections, for every kind or class of notoriety, ranging from the fake inspector, the newspapers mentioned as being in Lancaster county, to Professor Surface himself. But without elaborating on the point of how the Inspector is received in this county, I would say that in general, the treatment, interest, and hospitality are par excellence. Just to show the willingness to follow directions, or rather to get directions to follow, I had two requests to-day (Oct. 28), from W. H. W. and E. O. C., saying that the men in their respective neighborhoods had asked each of them to try and secure the State's aid, through me, in helping to prune and spray a part of their orchards, so that all in their neighborhoods might improve their latent orchards. I have many such requests each month.

Orchard planting is decreasing in this locality, due to the unreliability of fruit tree agents, and so many of their trees not proving true to name. It is not necessary to go into details. To mention tree-agent Schaffer, and his exorbitant prices for oak-root grafted trees, is but a remembrance. As far as land, soil condition and nearness to market are concerned, the locality of Potter and Tioga counties is first class. Here Northern Spy, King, Baldwin, Rhode Island Greenings, Talman Sweet, Pippins, Twenty-ounce, English Streaks,

these men practically live within sight of the Tioga county demonstration orchard.

L. D. Ripple, one of the ex-County Auditors of Potter county, sprayed his orchard with lime-sulfur for oyster shell scale, which was killing his trees, and as a result saved his trees and received in the Austin market twenty cents more per bushel than his neighbors.

The Benson Estate, of Coudersport, bought a Gould's Pomona spray pump, and the Inspector gave them a helping hand in getting started in spraying their orchards this year.

Robert Olmsted, a young lawyer of Coudersport, bought a large farm with two good orchards on it last year, and began spraying his trees. I have a letter here from Homer Howe, of Wellsboro, which I would like to read to you:

"Sometime ago you asked me what success I was having with my orchards and berries. I am sending you for your opinion a few samples of my apples that I have just gathered.

"Since I saw your demonstrations, and heard the talk you gave at the Hatherill farm in the spring of 1908, I have been following those directions as best I could, with marked success in my orchards; and now do realize that an orchard, instead of being a nuisance, and in the way, can be made one of the most profitable and pleasant parts of the farm.

"You may not know that two years ago my orchards were practically abandoned and used for pasture. I was shaking most of the apples and selling them for seventeen cents to forty cents per hundred weight, at the cider mill; I am now proud to say that I have orders from private customers for the most of my choice fruit (Spys and Kings) at \$2.00 per box. The boxes hold from 96 to 120 wrapped apples; and the barrel apples, which are mostly Ben Davis and Baldwins, I have sold at \$1.50 per barrel, the dealer furnishing the barrels. Although it has taken a great deal of hard work in pruning, cultivating, fertilizing, spraying and thinning, to bring about this change, it has paid, and has been a great satisfaction. I have kept a little memorandum for my own benefit from a few trees which have not been cared for. By careful account this year they average about 12 per cent. good apples; trees sprayed and trimmed 65 per cent. good; others sprayed, trimmed and thinned in July, 85 per cent. good.

"I am very thankful for what the State through your work has done for me. There are many others in this section making great improvements in their orchards since your demonstrations.

"As to strawberries, from two acres (15,600 plants), set in the spring of 1908, I sold this season 70,000 plants, averaging \$5.50 per 1,000 and 10,340 quarts of berries averaging 8 cents per quart.

"Please do not think me presumptuous in writing to you, but I am getting 'awakened' about apples.

"Respectfully,

"H. B. HOWE."

Mr. Howe is one of the most up-to-date men in the potato, strawberry and fancy apple raising business in the county, and his results are indicated in his letter.

The general opinion is that peaches can not be grown in this mountainous region of the State, but I would like to mention one case, that of Mr. Vanderhoof, of Middlebury township, Tioga county. Mr. Vanderhoof has 1,000 (5 acres) bearing peach trees. From these trees

this year he will realize over \$1,600.00. Mr. Vanderhoof has made a careful study of the peach business, and knows just what each tree needs. They are properly pruned, and this year during the drouth they were cultivated continually.

There is no co-operation among the farmers and fruit growers. The farmer is the fruit grower, and until there are a number of commercial orchards planted and properly taken care of, there never will be any fruit organization here. The farmer, with his little home orchard, can never expect to make a fortune. It is the man who plants lots of trees, studies them, takes proper care of them, that is to be successful. To think of all the waste land and cheap land, admirably adapted to winter apples, but lying idle, is something to make one's thinking apparatus work and his hands grip. I think that one of the broadest fields of this Department, outside of saving the scale-infested trees, already set, is to put the advantages and possibilities of practical fruit-raising before the people of Pennsylvania. They have no way of obtaining this knowledge, except through this worthy Chief of ours, and we who try to ably assist him. It seems to me there is one Division sorely lacking in the Department of Agriculture in this State, and that is a Division of Horticulture.

I will admit that the stories are good, and that there is good resulting from the lecturers who come from the southern or eastern part of the State to our region and lecture at Farmers' Institutes, on fruit subjects. But real practical work, by this Department, or by a Division of Horticulture, is what will count in lessening the humdrum life of the farmers, who often attempt to raise crops not adapted to their soils or locations, when there is the broad field of interesting and successful fruit-raising before them, only needing some guiding hand and inspiration to lead them to it.

SNYDER COUNTY.

Inspector, T. C. FOSTER, *Winfield, Pa.*

Mr. Foster's counties, Centre, Perry, Snyder and Union.

In Snyder county, where much was done in the way of holding public spraying demonstrations in every township of the county, the spraying idea has taken hold of the majority of the up-to-date peach growers. One owner of a commercial apple orchard, Mr. F. E. Boyer, of Mt. Pleasant Mills, who has been using the Commercial and Home-

were made, showed 25 per cent. of the orchards of the county infested, and about 10 per cent. of the trees. Much has been accomplished in the way of commercial spraying.

SOMERSET COUNTY.

Inspector, R. F. LEE, *Somerset, Pa.*

Mr. Lee's counties: Bedford, Blair, Cambria and Somerset.

In my present territory of Somerset county I know of only seven places of infestation with San José scale, as only a few young trees have been planted in the last fifteen years. I find mostly the oyster shell and scurfy scale on the apple; seldom doing any injury to the large trees, yet present on the trunk and larger limbs. The young trees, fifteen years old or less, are quite often badly injured; usually many are damaged. I know that the San José scale is on the increase in Bedford and Blair counties, and more than half the places are infested in each.

I have had no opportunity this summer to judge as to the efficiency of the different sprays, except the good results of my own spraying with lime-sulfur for oyster shell and scurfy scales and aphids.

The aphids or plant lice have come to stay, I believe, but can be controlled by the lime-sulfur wash used for oyster shell and scurfy scale.

The Bud moth, curculio (both of plum and peach), Codling moth, canker worm and all leaf-eating insects can be controlled by arsenate of lead.

The public seems much interested in our work, this interest being greatly due to the presence of plant lice, over which the general fruit grower was much alarmed. It will take some time to stir up their faith into work. The public, being so willing to use second quality fruit, is largely responsible for the poor quality of stuff offered for sale, seventy-five per cent. of which is hardly fit for anything but cider.

The majority of the time I am cordially received, but at other times indifferently. The people appreciate our advice, but I fear few will follow it, and will hardly buy a sprayer to do so. Their indifference is due to ignorance of the possibilities and knowledge of fruit culture. A few good examples of packing, to show what a first class package of fruit is, would help greatly.

The outlook for orcharding in Somerset county is fair. Conditions can not be better for nearness to markets and shipping facilities, but the fruit growers are lacking. A few large plantings will be made this fall and spring, and some general planting. Mr. D. B. Zimmerman will continue to add to his orchard of (now) one thousand apple trees; Miller Brothers will plant one thousand trees; N. A. Mos-

teller, at Friedens, will plant twenty-five hundred of all kinds, and a few others will plant. Mr. H. W. Walker, Somerset, has been the first individual to spray both with lime-sulfur, Bordeaux and lead arsenate. His one orchard, sprayed with lime-sulfur, has fine fruit. The other was hardly worth picking. He is also a successful peach grower, in spite of the idea that peaches can not be grown here. Somerset county is also a famous potato country, and more should be raised, graded and labeled. This would make the county famous.

The Demonstration Orchard at Ebensburg, Cambria county, was the only orchard in that region, as far as was known, that had any fruit this year. The seven trees left unsprayed with lime-sulfur were badly infested with aphids, which I think were responsible for the clustered and small fruit, as seen outside of the Demonstration Orchard.

There is little if any co-operation in Somerset county as far as I know. The prices for milk, live stock and general farm crops are good (always fixed by the purchaser, of course. H. A. S.), and farmers never co-operate until conditions force them.

Suspension of this work would give the insects a free field, as there would be no one to look after them, or remind the public of their dangers from insects and prescribe remedies. It would be a great mistake, and should not be suspended as long as insects are on the move and the people know so little of such pests and how to control them.

The young generation should be taught in our schools how to recognize these common pests and control them.

The long vacation for the inspector during the winter months, without pay, is the greatest drawback to this work. The public is under the impression that the Inspector is being paid for his time, and any attempt to do other work or engage in other business would bring both parties (employer and employee) into disrepute with the public. If we were paid while at work sufficiently to cover the time lost, the Inspector could rest.

Somerset county needs at least three demonstration orchards, so as to show all persons how first class fruit can be raised here. A circular describing the most dangerous common insects and fungus diseases, with remedies for their control, put into the growers' hands, would be a great help. We must, by plain facts proven before them, win them over from the indifferent to the confidential side. The inspector should have power to destroy worthless trees and fruit in stores, to curtail the insects found in and upon them.

SUSQUEHANNA COUNTY.

mock and Sprinkville townships, nearly finished Auburn, and have Rush and Jessup more than half covered. With two or three exceptions I find no up-to-date orchardists in the territory worked, and not more than four or five who have done anything in the way of spraying. I have found worse infestations of San José scale this year than last.

At Dimock there is a very bad infestation. At Lymanville there is a general infestation in an apple, pear and plum orchard. The San José scale in my territory is increasing, but has not as yet done a very great amount of damage, taking the territory as a whole, as I have only found four general infestations in the county. I think not more than four per cent. of the orchards have San José scale.

With one exception, lime and sulfur is the only treatment used in my territory for San José scale, as far as I know.

The exception was at Mr. Comstock's, in Montrose. He used whale oil soap and also the commercial lime and sulfur, during the year. I did not see the orchard until both had been applied. In controlling the San José scale it was successful, as the scale was confined to the young trees, but the work was not thoroughly done on the large trees and oyster shell scale was not killed. I have never found a case where the lime and sulfur failed when thoroughly applied.

I find apple seed chalcis very prevalent in my territory, and spraying at the usual time for codling moth with Bordeaux and arsenate of lead did not seem to check it in any marked degree.

Plant lice were unusually bad in my territory this year; covering the under sides of the leaves, and completely covering the small apples and branches in many orchards. I feel sure that they seriously injured the fruit, making it small and gnarly. Whale oil soap and kerosene emulsion were successful where thoroughly applied, but I know of only a few instances where used, and then on shrubs and small trees.

Leaf miners are also very prevalent, and I think that they are not lessened any by spraying at the usual time with Bordeaux and arsenate of lead for codling moth, as the worst case that I have found this year was in an orchard thus treated, under the supervision of Professors from State College.

Twig blight, although not an insect pest, is a disease that is very alarming throughout the northeastern part of the State. I have seen orchards that looked almost as though a fire had gone through them—limbs blighting back, in many instances, three or four feet.

The fall web worms were very plentiful in nearly all the orchards, and got their work in well.

In regard to the interest shown by the farmers and fruit growers, I feel justified in saying that there is a growing interest in the work. The more knowledge they have of the work that is being done, the more ready they are to receive the Inspector and give him assistance. As the work progresses and the farmers are informed of the work, less opposition it met. With one or two exceptions, I have met with no opposition during the season's work.

However, I have noticed in some instances that they still feel that the object of the work is to compel them to do something, rather than to give assistance, and they do not attend the demonstrations as they

should. Until they can be brought to feel that the work is carried on for their interest, this condition will exist, as it is a question of education, and it will take time to bring about the proper relations that should exist between the fruit growers and the Department.

It seems to me that this will be accomplished more quickly, and more effectively, by bringing the farmers and fruit growers in close touch with the Department through its literature and its representatives in field work than in any other way.

The outlook for orcharding in my section is not particularly bright, not that it could not be carried on successfully, but because few farmers in Susquehanna county have given the problems of fruit growing any serious consideration. They depend almost entirely upon the dairy. Therefore, this branch of farming is worked at the expense of others. Charles Van Gorden, at Auburn Center, has been quite successful in growing peaches. He has 2,200 trees, about half of that number bearing. He sold 1,400 to 1,500 bushels this year. Mr. Bolles, near West Auburn, in the same township, has a fine peach orchard consisting of about 400 trees. It is just coming into bearing and is well cared for. The trees are cultivated, which is unusual in my section. His orchard bids fair to be very productive.

F. H. Fassett, just over the line in Wyoming county, has a very fine apple orchard. He thought that he would have 700 barrels this year, mostly the Northern Spy.

I cannot say that there is a single apple orchard in all the territory worked this year that is being cared for along wholly up-to-date methods. I think that there are fewer trees being set out than in years past, due partly to the San José scale scare, but more largely to a feeling that orcharding does not pay as well as some other lines of farm work in this section; also to a feeling that it is much more difficult to grow trees than in past years, and to the fact that the farmers have been faked by so many unscrupulous fruit tree agents.

The farmers are co-operating with the work to some extent, but not as they should. They do not question that the care given the Demonstration Orchards is the proper thing, and that it accomplishes the results claimed for it. They have even spoken more favorably of the work done at the Demonstration Orchard at Montrose, than I would if I were to pass judgment upon it myself. Still, they neglect to do much in the way of improving their orchards.

To suspend the inspection and demonstration work at the present time would be a mistake, in my opinion, because the work is only in its infancy, at least in certain parts of the State. There are only a few, comparatively, who get to see the demonstration orchards.

True, it is their own fault, but they do not realize the importance of the work in sections where there is so little scale as they do in those districts where the trees are being killed by San José scale. It is an education that is going to take time. I believe the Demonstration Orchards, for the time used in caring for them, are doing even more, if possible, to convince the fruit growers of the importance of caring for their trees, than is the inspection work. I believe these orchards should be more numerous.—There should be several in each county, if possible.

We, as inspectors and demonstrators, should equip ourselves more efficiently for the work, and give our very best efforts to the Department and those in whose behalf we are engaged.

TIOGA COUNTY.

(See Inspector Benn's Report for Potter County.)

(See Inspector McNett's Report for Cameron County.)

UNION COUNTY.

Inspector, T. C. FOSTER, *Winsted, Pa.*

Mr. Foster's counties: Centre, Perry, Snyder and Union.

In Union county, where the work of inspection was completed three years ago, spraying has not been engaged in to any extent, although good results mark where it has been thoroughly performed. A former report covered the extent of scale infestation in the county, which at this time has changed from the original figures. The Demonstration Orchard at Vicksburg has been visited by a goodly number during the past two years, and its owner, Mr. Newton Glover, is desirous of having the work continued.

VENANGO COUNTY.

(See Inspector McClure's Report for Butler County.)

WAYNE COUNTY.

Inspector, W. H. BULLOCK, *Honesdale, Pa.*

In my inspections in Wayne county, I have not found the San Jose scale general; but as the work, as yet, has extended over only a small portion of the territory, it would be impossible at this time to give a true estimate as to what extent it prevails in this section. It is known, however, to exist in several widely separated and isolated

places, and it is certainly on the increase, as but little or nothing is being done to repel it. I know of only one orchard that has ever been treated for the San José scale. In this case the regular lime-sulphur wash was effectually used. At the present time the nature and appearance of the San José scale are little known in this district.

We have another pest, in the form of the oyster shell scale, that is doing much injury to our apple trees by sucking out the sap and injecting a poison. It is found in every orchard to a greater or less extent, and it is surprising how many we meet who have fruit trees and who are not acquainted with this common and ever present scale. Only last week I met a man who is interested in the growing of fruit to the extent of 650 trees, and he had a goodly supply of this scale, and did not know it. Another man not far distant mistook the oyster shell scale for the San José scale. He thoroughly whitewashed his young orchard with fresh lime, and claimed that he saved his trees by so doing. He informed me that his orchard has done exceedingly well ever since, and he has sold his apples at \$1.50 per bushel while his neighbors were selling at \$1.00 per bushel.

We have another scale which I have heard very little about, that is the Putnam's scale. I discovered it first in the borough of Prompton, and later in South Canaan township, where I frequently found it. I would say that one-half of the orchards in that section are slightly infested, and I know of its whereabouts in several other localities.

Very little spraying of any kind has ever been done in Wayne county. The only orchard that has come to my notice that had been treated with the Bordeaux mixture is situated in South Canaan township, and consists of 700 nice young apple trees, that show unmistakable signs of generous care. All of the trees are of bearing age, but the mixture was too strong and the effect was discouraging.

If I am allowed to judge by the number of persons who talk of purchasing spraying outfits, and by the number of formulas that I am requested to write, there will be a good number of outfits sold in less than a year hence. There is a growing interest in the work, especially by the young men.

We find that there are a large number of young trees being set out (and I am convinced that the number is rapidly increasing), and some of them are thriving; as in the case of the Hull Brothers, of Waymart, who have recently set out 4,000 trees, all of which are making a wonderful growth, and they intend to extend the work to several thousand more. On the other hand, we frequently find young orchards that will be a total failure for the simple reason that the occupant does not know how to handle and treat his trees successfully.

The inspector is cordially received, and, on the whole, the work set forth by the Department is being greatly appreciated, and much in-

WESTMORELAND COUNTY.

Inspector, WILLIAM H. RODGERS, *Mifflintown, Pa.*

Since May 18, 1909, I have been tramping over the hills, and through the valleys of Westmoreland county; inhaling the odor from coal mines, coke ovens and gas wells; climbing barbed wire fences; pushing my way through tall briars and tangled ivy; and evading savage dogs, in search of the omnivorous San José scale and other pests that infest plant life. I am free to confess that I found orchards and orchard conditions in that county very much neglected and dilapidated. Corporations interested in the use of gas (natural gas) for manufacturing purposes, have decorated the hills and valleys with immense derricks, illuminating the dark nights with constantly burning lights, and fumes of gas fill the air. Many properties which have come under my observation, containing fine large orchards which, under proper conditions, would be thrifty and productive, have been purchased outright by some gas, steel or mining company, and the orchards and all surface conditions, except that which produces food for stock, are left to the ravages of the elements; and those not purchased outright, are either leased for a good round sum annually, or the mineral interests purchased at such a price as to enable the owners to live at ease, and leave surface conditions to tenants for a nominal sum, who take very little interest in their preservation. Taking out the large veins of coal in the earth has dried up the springs and streams to an alarming extent. In many neighborhoods the people are entirely without spring or well water.

Great depressions are visible in fields and orchards into which trees have tumbled, and large fissures in the earth disturbing the erectness of buildings, fences, etc., give one a sort of uncomfortable and uncertain feeling in relation to his footing. I am of the impression that it has produced results very injurious to plant life by conditions that years will not eradicate. These together with the pests which are found everywhere in great numbers, militate against, and very greatly discourage, those engaged in raising fruit, so that Westmoreland county is not a paradise for the fruit grower. I was almost daily met with the statement: "We cannot raise fruit here anymore. Since the mines, coke ovens and gas wells have been in operation the trees have been on the decline." They blame the smoke, sulphur and gas for killing the trees, and yet in the midst of it all, I have once in a while found trees in a most healthy condition, producing fruit of the very best, commanding a price far in excess of anything shipped in, as they have the best market here in the world, but the trees had the best of care—illustrating conclusively that there are neighborhoods here in which immense fortunes can be made in the next several years by the men who have the nerve and the energy to take advantage of this golden opportunity.

In answer to questions I will state as follows:

No. 1. Is there much San José scale in your district?

Answer. There is. It is found on almost all premises; on some in such great numbers as to have destroyed many trees, and is sucking the life out of many others. If its ravages are not stayed by quick action on the part of the owners in the near future, thousands of dollars will be lost to the fruit tree owners of Westmoreland county, and it may be seemingly incredible when it is stated that not one in one thousand knows of its presence and does not know what it looks like. Yet this is true. In my visits to over twelve hundred premises I found but two persons who knew San José scale. My observation is, unhesitatingly, that it is on the increase. Where peach and plum are found, at least 90 per cent. of the orchards are infested, while on old apple trees it was difficult to find on the trunks or lower limbs. After the fruit began to drop, I frequently found it on the apple laying under the trees indicating its presence on the tender upper branches. I should judge that about 30 per cent. of the trees in orchards in general are infested and would consider this to be a fair average. In some orchards only a few trees were infested, and again I would find it on every tree in an orchard.

No. 2. What remedies have you found to be efficient, etc.?

Answer. I would state the lime-sulphur wash has been generally accepted as producing the best results. As to my own observations in dates of spraying I cannot make any statement, but from statements made, and results shown by parties who made the tests, the late fall gives the best results, as the spray loosens the scale, and the cold weather following freezes and helps on the work, lime-sulfur wash has been uniformly successful.

No. 3. What remedies have you found inefficient, etc.?

I would state that in a number of instance some commercial sprays were used without success. Parties could not remember names, and receptacles were destroyed. In two instances lime-sulfur was used when trees were in foliage, killing the leaves. It was early in the season and when I visited them in August the leaves on the young trees were coming out again more brilliant in hue than ever.

No. 4. What other serious insects have you found, etc.?

The apple plant louse was the most serious I found. It appeared by the thousands in May, infesting the under side of the leaves, and left them so they could not perform their proper functions. On all bearing trees the fruit spurs were so much sapped that the apples failed to develope. It had accomplished its devastation, and was gone before any remedy was tried. In every apple orchard in which the curled condition of the leaves, and undeveloped condition of the fruit, indicated its presence and blight, I found no other pest so serious.

No. 5. Is the public keeping proper interest in the inspection?

It is, but to many it is necessary to explain and when that is properly done the interest increases. They are anxious to learn all about it. Many, very many, do not understand why an inspection is necessary, and will insist that it is not, but when made to understand that it is done at the instance of the State, and without cost to them, they begin to warm up, and are willing to have me proceed. Very often I find a tree near the door; on my way, infested with San José scale; and if a lady has met me I invite her to take a look at it through the glass. She responds, and after taking a peep, immediately calls for the rest of the family, often bringing the baby and sending a child to

the field to tell "Pop" to come. Then often the whole family follows me, with "Pop" leading the way, from tree to tree, firing questions at me like cannister out of a cannon, until I must call a halt, close up, and go to the next.

Coming out of an orchard, I found the owner sitting on the fence talking to a neighbor. I told them who I was and my business, and was met with the usual statement: "We cannot raise fruit here any more," etc.

"No." I said with all due respect, "you cannot raise corn, you cannot raise potatoes, you canot raise anything, and sit on the fence and look at it." Pointing, I said: "Look at those few nice large apples scattered over that tree. You can't tell me when there was a cultivator in that orchard, when that tree received one particle of attention. You treat no other friend so ill, and yet amidst all your neglect and ill-treatment I doubt if there is one spot on your farm of the same dimensions that is doing as well by you as that tree."

The man came off the fence with the statement that what I said was true. His friend got out of the buggy and hitched his horse, and I was marched all over the orchard, invited to dinner, to come back and spend the night, and always to stay there when in the neighborhood.

No. 6. How is the inspector received where his object is known?

Answer. Often grandly; when not known. indifferently; and where the people are ignorant or over-smart, often badly. Many are unusually anxious to follow instructions; some are different; and some don't care a continental.

No. 7. What is the outlook, etc.?

In some few places, very good; but the vast majority of people are utterly indifferent, and it will take a strenuous compulsory law to eradicate the pests, or even to, in any measure, stop their ravages.

Progressive men are O. J. Mechlin and Clarence Kepple, of Leechburg; Robert Burleigh, Buzzard and Conner. Planting is neither increasing or decreasing. The outlook could be much improved by greater effort along lines laid out by our Economic Zoologist, if greater assistance was given him by the State.

No. 8. Are farmers and fruit growers co-operating?

Answer. Not in the way of organized effort. The contest is all in the line of individual effort.

No. 9. What would be the result of suspension, etc.? Disastrous.

No. 10. Suggestions. Townships might be helped by having some well known citizen of good character and standing, who was familiar with the various pests and remedies to whom they could go for information and advice. I have spoken to ministers, telling them what help they could give, and many of them are showing the pests to their parishioners, and advising them of the remedies. I have even suggested that they could not get a better theme on which to preach a sermon than the San José scale; one of the smallest insects and yet the most destructive.

I am an advocate of the Department issuing a folder under the direction of our very worthy Chief, Professor H. A. Surface, say of four leaves, with formulas for a few of the worst pests and time to use them. A few hundred could be carried readily by the inspectors without very great effort, and they would save much time,

All of which is very respectfully submitted.

WYOMING COUNTY.

(See Inspector Knuppenburg's Report for Bradford County.)

YORK COUNTY.

Inspector, E. F. PEIRCE, York, Pa.

Since making my last report I have found scale in over 99 per cent. planted last year, which offer little attraction to birds as an alighting place, on perhaps 90 per cent. of the trees. The infestation of the orchards which I have inspected, and excepting young trees ranges from very bad, near the buildings, where are the plums, peaches and pears, to very slight on old apple trees, at a distance from these fertile hatcheries.

Where the infestation was very slight in the main orchard, I have earnestly endeavored to impress upon the mind of the owner the advantages of attending at once to the small sources, pointing out how "a stitch in time" may save many times nine.

The list of remedies, which have been used in the orchards which I have inspected this year, is short: Boiled lime and sulfur, prepared lime and sulfur, at different dilutions, and scalecide, at different dilutions. I have found failures and success with each.

One man rubbed his trees (young ones) with salt bacon. Whitewash is the almost universal application. This is sometimes effective on peach when cut back and treated to a thick coat. Lye and paint have been used on a few small trees, but not extensively.

The boiled lime-sulfur has been successful when properly made and thoroughly applied. Where it has failed it does not take much questioning to discover why, and it is usually admitted that the tree was not thoroughly covered on account of (1) "difficulty of access," (2) windy weather, (3) haste, etc.

They "intended to finish the job later," but good intentions won't kill scale. At one place I nearly despaired of finding the cause of failure. The men were all from home. The lady of the house was much interested in the trees. They had used fresh lime. They had boiled it with the sulfur more than an hour. They had thoroughly covered the trees. At last I found that it was done on a damp day, and that a heavy rain set in just as they finished. That was reason enough for me.

I endeavor to rub in the lesson of thoroughness, speaking of the number of scale to the square inch, and rapidity of multiplication. I have not found any of the remedies inefficient when properly diluted and thoroughly applied, unless I expect whitewash, which I have not regarded as a remedy, and have not thought it necessary to mention in my reports.

I have not observed any difference in results on account of date of spraying. It is sufficiently difficult to ascertain the year. I have found very few trees of which I could say positively that the spray material had injured them. There is, however, in my mind, no doubt whatever that an orchard which has been sprayed for several years with lime-sulfur will always present much more thrifty and healthful appearance than an orchard sprayed for the same number of years with any of the oils. I am not prepared, however, to say that the oils injure the apple and pear trees. I am inclined to think that the difference is mostly on account of the great benefit which the lime-sulfur wash exerts as a fungicide.

Other serious insects in the district are the scurfy scale, oyster shell scale, round-headed apple borer, peach borer, leaf hopper, aphis, and, of course, the ubiquitous Codling moth.

The scurfy scale is bad only on young trees, and on the lower limbs of trees which need trimming badly. It is worse on trees which are planted too closely, and which have grown to form a thicket. The bark of these overshadowed limbs is thin and soft and especially favorable to the spread of both scurfy and San José. Last year I found apple trees badly infested with oyster shell scale, but this year I found it mostly on lilac, willow, a few plum trees, and silver maple. At one place there was a row of large willow trees absolutely covered with it, and I was not able, in a ten minute search, to find a single one on an apple tree which stood not more than twenty-five yards distant.

The round-headed apple-tree borer is pursuing his dastardly vocation in practically every orchard, unchecked, except by specialists in fruit growing. The same may be said of the peach borer, with the added statement that he is in my district rather a friend of the farmer, in that he hastens the death of the scale-infested Yellows disseminating peach tree, which is the kind of peach tree I have learned to expect to find.

The aphis was particularly numerous this year in orchard, street and forest. The leaf-hopper not nearly so bad as last year, tho' this may be a better section. The Codling moth still has things pretty much its own way. I met with a few exceptions where pyrox was used with excellent results.

Is the public keeping proper interest in the inspection and demonstration work? Each man begins to take a "proper interest" when he walks through his bearing apple orchard, and finds some cherished tree all crusted over with scale. There is one saving condition. There is not a neighborhood but contains at least one man who reads and thinks and is prepared to set an example. They are influential men.

In the meantime many old ones will be lost, or irreparably injured, but the natural advantages of York county as a fruit growing district, and the efforts of the Department of Agriculture to enlighten will insure a great future in this line. Howard Anderson and John Baird, of near Stewartstown, and M. H. Baer and a Mr. Forry, of near Spring Grove, are up-to-date orchardists. The two former have already reaped large profits, and the success of the two latter is assured by a co-partnership with a brother of Inspector Herr, and being in a sense a brother-in-law to all of us, it is impossible for him to fail. He personally assured me that no tree in these orchards should ever suffer from the San José scale.

The farmers and fruit growers are co-operating to a certain extent, but not by any means to the extent that they should. There are several wide-awake farmers' clubs and granges in the county, but there is need and room for many more. There are, in my knowledge, one or two localities where I am confident that any kind of concerted effort would result in organization.

A suspension of the work of the Division at present, would be a calamity. That word may sound strong. Well, I believe firmly that it belongs right where it is. The most extensive and the most progressive fruit growers need most the assistance which this Division is prepared to give them, because their interests at stake are greater. As others fall into line, they will need the same assistance. It is surprising how many ways there are of not doing it right.

I feel very timid about offering suggestions for the improvement of the service. If our Chief were strictly an office man he would no doubt be benefitted by suggestions from those in the field. But he is himself of the field, and has already weighed and tackled every idea which would be likely to occur to me. I will content myself with repeating my suggestion of last year, namely, that the State should manufacture remedies and furnish them at cost. This plan would result in incalculable good. There is an idea abroad that the State should not enter into competition with private interests. I believe it to be a mistaken idea. The principle of "the greatest good to the greatest number" is a safe working principle for communities or nations.

6. INSPECTION OF IMPORTED PLANTS, SEEDS AND FRUIT.

We have found it necessary during the past year to give more strict attention than ever before to the subject of imported plants because of the increasing number of pests thus finding their way to our State. We have been working strictly in co-operation with the authorities of the U. S. Department of Agriculture in the inspection of imported plants, and by so doing have been able to keep informed from the ports of the entry of the various consignments coming into this Commonwealth. It has indeed been a great task but we have

vigilance of the inspectors. Only one or two masses of the Gypsy moth eggs were found, but these might have been enough to start an infestation that would mean the loss of millions of dollars, if not checked in its incipiency.

One of the worst diseases that could be imagined is the White Pine rust. This is being imported at present from certain nurserymen in Germany and France, and we are consequently watching very carefully for it. Our inspector, Mr. Windle, has recently found young pine trees infected with this deadly pine disease, and we have sent specimens to experts at Washington, who have confirmed the identification. Special efforts have been made to inspect all white pine seedlings brought into this State.

The work has been tremendous, and it has involved the inspection of hundreds of thousands of white pine trees. However, it is only by such efforts that we are able to secure the desired results.

In the inspection of imported plants our representatives have aided in opening and inspecting not less than nine hundred cases containing over one thousand plants to a case, or, in other words, over one million imported plants examined within a year.

7. MAKING COLLECTIONS.

We have continued the preparation of a systematic and economic collection of Pennsylvania insects, keeping the notes in full, and preparing specimens in a first-class manner. Our collection is now one to be considered in making a study of the important Insect Collections in America. Hundreds of breeding cages have been kept for the purpose of bringing the insects to maturity, to obtain them in the adult stage, so that they can be named accurately, and specimens in the various stages have been preserved for the purpose of comparison.

Specialists in different parts of the country, who have helped to name them, have reported to us that these are among the best preserved specimens that they have seen. The great difficulty with keeping insects in cages is, that in the present room where they are, the dates of their appearances in different stages are abnormal, and we can not obtain dates of normal or outdoor developments. This is due to the artificial temperature of the present quarters of the breeding cages.

Few collections contain insects preserved in their various stages, as practically all systematic collections contain only those in the adult or mature stage. On the other hand, the farmer and fruit grower sees many insects only in the immature stages, and, consequently, these stages should be preserved in our Collection, and the life histories worked out and published in full with description. Mr. V. A. E. Daecke, of Philadelphia, and Mr. W. S. Fisher, of Steelton, have been assigned to the special work of the collections, and have been interested in putting them and the records in the best possible condition. The system of filing records is such that everything is in good order, and desired information concerning any material collected and sent to us, can be obtained promptly at any time.

We have not done very much with collecting the animals higher than insects during the past year, excepting the Amphibians, including the frogs, toads and salamanders. The chief reason for this is, that our Bulletins on Serpents, Turtles and Lizards have been completed and published, and there was no need of pushing the work

along these lines at present. We are just now bringing to completion a bulletin on Amphibians, which will be parallel to those on the true reptiles.

Our friends continue to contribute specimens of various kinds, either for the purpose of gaining information, or of sending something that is supposed to be useful in the museum collection. All such as are desirable are numbered and entered in an accession catalog, and are properly preserved. Those pertaining to plant diseases or undesirable are not numbered. During the past year the number of accessions for our Collections were 1777, showing that this branch of the work has progressed well.

8. DEMONSTRATION ORCHARDS.

We found by actual experience that it was not best to rely upon printed and oral instructions to reach the public and give them the help they need in pest suppression. The one thing, above all else, that was necessary was to have a competent or well qualified person go into the community where pests were present, and give a practical public demonstration, showing exactly how they are suppressed in the most economical and effective manner. In our methods of public demonstration we have made considerable growth.

This work was first undertaken by fixing a schedule over the county, and the inspector or demonstrator going to an orchard selected, at the appointed hour, hauling his spray pump and outfit with him, meeting the public, and doing spraying on that day, and then passing on to another place for a further demonstration just as soon as possible. We found that the great objections to this plan were, that the owners did not have apparatus, and did not continue the further spraying of their orchards in the proper manner, and that the weather was very liable to be unfavorable, as by rain, storm or wind, on the day fixed for the public demonstration. If the demonstrator did not do perfect work on that day, the pests were not killed. While we were showing the method of doing the work, the public expected us to clean the trees with such results that the pests, especially the San José scale, would be exterminated or reduced to a minimum.

To give the results which the public demanded, it became necessary to make plans by which it was possible to stay at an orchard until it was properly sprayed, rather than merely spraying one side of a few trees, and letting the other side go untreated, because of the unfavorable wind on the day in question. Therefore, we changed the plan of giving demonstrations, and this year selected as regular demonstration orchards to carry throughout the entire year, certain orchards, which were connected with public institutions, such as asylums, county homes, orphans' homes, farm schools, etc. Either the owners of the premises furnished the spray pumps, or we established our own pumps at the institutions, and were thus able to have the proper work done on different days, so as to be sure to find weather favorable to its completion and, consequently, proper results. The outcome of this method of demonstration work was very satisfactory in many regards. Some of the inspectors have mentioned this in their reports. However, we found the elements of the old truism, "What is everybody's business, is nobody's business," and at some of the public institutions there was no one greatly personally interested in the care of the demonstration orchards. The inmates gathered the fruits at

such time, and in such manner as made it impossible for us to keep accurate measurements or accounts, and the orchard did not have the same kind of care that the individual grower gives his own trees. Therefore, we are again changing the plan of the demonstration work, and intend hereafter to establish three or four local demonstration orchards in each of the fruit-growing counties, selecting these from among the orchards owned by persons who intend to give them personal care, and who will co-operate with us in making this work fully successful. This will be done, not only by proper methods of spraying, but by cultivation and fertilization and other important means. We have already seen enough of this proposed plan to be satisfied that it is the best that is possible.

Last year demonstration orchards were located in various parts of this State as follows:

County.	Location of Demonstration Orchard.
Allegheny,	Beechmont Farm and Fruit Co., Oakdale, Pa.
Berks,	County Home, Shillington, Pa.
Bucks,	National Farm School, Farm School, Pa.
Butler,	County Home, Butler, Pa.
Cambria,	County Home, Ebensburg, Pa.
Chester,	County Home, Embreeville, Pa.
Clearfield,	County Home, Clearfield, Pa.
Columbia,	Bloom Poor District, Bloomsburg, Pa.
Cumberland,	Indian Industrial School, Carlisle, Pa.
Dauphin,	Harrisburg, Pa.
Delaware,	County Home, Lima, Pa.
Indiana,	Industrial Reform School, Huntingdon, Pa.
Huntingdon,	Frank Dougherty, Indiana Pa.
Lackawanna,	Randolph Crippen Estate, Dalton, Pa.
Lancaster,	Home for Friendless Children, Lancaster, Pa.
Lancaster,	County Home, Lancaster, Pa.
Lebanon,	County Home, Lebanon, Pa.
Lycoming,	Williamsport City Home, Williamsport, Pa.
Mifflin,	County Home, Mifflin, Pa.
Montgomery,	State Insane Hospital, Norristown, Pa.
Montour,	State Insane Hospital, Danville, Pa.
Northampton,	Carter Junior Republic, Redington, Pa.
Northumberland,	Odd Fellows' Orphanage, Sunbury, Pa.
Perry,	House of Employment of Perry Co., Loysville, Pa.
Potter,	County Home, Coudersport, Pa.
Tioga,	Geo. Hatherill, Wellsville, Pa.
Union,	J. Newton Glover, Vicksburg, Pa.
Venango,	Institute for Feeble-Minded, Polk, Pa.
Westmoreland,	County Home, Greensburg, Pa.

9. DEMONSTRATION TRAINS.

One of the new features of the year was the establishment of demonstration trains on the Pennsylvania and Cumberland Valley railroads. As mentioned in our last Annual Report, such train was run on the Cumberland Valley railroad during December of the previous year, which was during the time covered by that Report, and

also during January of 1909. During February of the same year, the Pennsylvania Railroad Company very generously placed at our disposal a train for demonstration purposes, running it according to fixed schedule, and meeting all appointments promptly and cheerfully. This was chiefly through the instrumentality of Mr. William J. Rose, Division Freight Agent of the Pennsylvania Railroad, of Harrisburg, who is himself a practical farmer and fruit grower, directing a large and successful farm, and tremendously interested in the welfare of agriculturists. Mr. Rose kindly aided us in perfecting necessary details of plans for train service, and every employee of the Pennsylvania railroad contributed toward the success of this remarkable undertaking. Spraying and pruning apparatus were carried on the train, and the actual work of methods of pruning trees and spraying for San José scale and other pests, was shown in the presence of the assembled multitudes. People came for long distances and were satisfied with what they learned. As a result of this effort more planting, pruning and spraying have been done during the past year than in any three years previous, and, as a further result Pennsylvania is sure to become a prominent fruit state. She has the soil, the climate, the excellent varieties and the intelligent citizens. All that is necessary is for them to be told that they need not be discouraged on account of the dreaded San José scale. This pest now presents only a solved problem. There is no longer any doubt of the ability of the horticulturists to produce perfect fruits in spite of its presence.

Our experiments with insecticides have again given emphasis to our previous conclusion, to the effect that the boiled lime-sulfur wash was the best and cheapest known remedy. In the demonstration work the lime-sulfur wash was made and applied to the trees, and its efficiency was plainly demonstrated. So interested were the people in the region traversed by the demonstration train, that they requested a continuation of the service, and the Railroad Company generously gave intimation that such would be continued during the subsequent year. A detailed report of this train service for 1910, will be published in the next Annual Report.

10. EMPLOYES OF THE BUREAU.

It is my pleasure to acknowledge faithful service rendered not only by the Inspectors and Demonstrators, whose names are attached to their respective published reports, but also to the employes connected with the office, including those holding positions established by general legal enactment, as well as those holding positions under provisions of a special fund. Among such persons are to be mentioned the following: Mr. V. A. E. Daecke, Clerk; Miss K. P. First, Stenographer; Mr. A. B. Champlain, Messenger.

While those assigned to special work and who deserve mention for faithfulness in the execution of duties are: Mr. W. S. Fisher, Recording Clerk; Mr. W. R. Walton, Artist; Miss H. M. Nesbit, Accountant and Assistant Stenographer; Miss A. L. Boyer, Special Assistant; Mr. Ross Workman, Mailing Clerk, and Mr. Paul Meyers, in charge of insects.

11. PLANS FOR FUTURE WORK.

There is no reason why the work of this Division should be turned into any channels greatly divergent from those which have proven successful the past year; yet it is proper during another year, as at all times, to work upon definite plans. These include the following:

A. Extension of the orchard demonstration work, so that Model Orchards can be established under our supervision, upon private premises, where they will be given definite modern attention by the owners.

B. A plan for Supervision Orchards, which will give all private owners who apply for it, the benefits of the services of this office, in conducting their orchards, even though theirs may not be the place selected for Public Meeting Demonstrations.

C. The continuation and enlargement of the Demonstration Train service.

D. Co-operation for agricultural exhibitions at county fairs, as far as may be possible.

E. The completion of the inspection of private premises, as soon as the funds will permit this work to be done, in order that we may start again in the territory which was first inspected five years ago, and during which there has been plenty of time for new pests to come.

F. Special attention to importation of pests, which may be brought into this country upon foreign shipments.

G. An Insecticide Law which will protect our people from the evils of ineffective, fraudulent or injurious preparations.

H. The establishment of apiary inspection to determine the presence of foul brood among bees, and to help stamp out such serious bee diseases.

I. The establishment of an experimental orchard on independent premises, where there will be opportunity to test various kinds of insecticides and fungicides, as well as methods and apparatus.

J. The establishment of an insectary room, which will give us opportunity to keep our living insects throughout the year in normal conditions, in order to obtain normal dates of development, for comparison with the natural progression of insect life in this State.

In support of some of these features of suggested work, I must say that conditions in this State, as in other states are rapidly changing, due to the intervention of man, the importation of pests, the changing of varieties, the declining of soil fertility, and the modification of methods.

For example, a few years ago but little attention was paid to apiculture as an art in Pennsylvania. The perfection and introduction of the modern frame have made it possible for that to become a true agricultural art, based upon definite science. Many bee-keepers then developed, and the production of honey reached the extent of millions of pounds annually. The production of honey and beeswax and the sale and income from the same, as well as the sale of bees, made bee-keeping a branch of agriculture giving a revenue of millions of dollars annually in this State, besides the immense income to fruit growers from the necessary desirable results of the bees in fertilizing their fruits in carrying pollen from flower to flower. The natural activity of man in endeavoring to procure new races of bees, especially by modern methods of queen shipment and introduction, exchange

of supplies and equipment, and the shipment of honey, resulted in the introduction and spread of two terrible bee diseases, namely, foul brood and black brood. These diseases are so deadly in effect, and so difficult to detect with accuracy, that they are liable to wipe out the entire apairy before their presence is detected. Even then the ordinary bee-keeper does not know that such diseases are present, nor does he know what to do for them. Just as our San Jose scale inspection work in this State is rendering an exceedingly important service, by sending specialists into the orchards to determine the presence of the scale, and tell the owners what to do to save their property from destruction, so would a system of apairy inspection result in the detection of bee diseases and the preservation of valuable property, which must otherwise very soon be lost completely.

In several counties throughout Pennsylvania, especially along the mountain regions, the deadly bee diseases have made their appearance, and these can never be checked until competent persons go forth as inspectors, just as is now being done in many of the other states. I earnestly hope to see a foul brood law and the establishment of an Apicultural Inspector.

In each of my previous annual reports I have mentioned the importance of an insectary for keeping insects alive and studying their habits, their food, their enemies, dates of transformation, etc. I trust this can soon be accomplished, as it will be one of the greatest aids to the scientific work of this office.

The establishment of an experimental farm, even though small in extent, must necessarily give valuable returns. The idea would not be in the least to duplicate or oppose the important experimental work done by our State Experimental Station but rather to co-operate with our able authorities there, to such an extent as is possible in working for the one common and fundamental principle of pest suppression. The State of Pennsylvania is large enough, and the needs are surely great enough, that all can find work to do, if means be but supplied.

12. ACKNOWLEDGMENTS.

As Economic Zoologist, I wish briefly to acknowledge the help that has been given this office by the uniform courtesy and co-operation of Governor E. S. Stuart; Hon. N. B. Critchfield, Secretary of Agriculture; the Board of Public Grounds and Buildings; the Pennsylvania Railroad Company; the Inspectors and Demonstrators of the Division; the office employes, with one exception, and the various firms who have contributed apparatus and supplies for the demonstration, experimental and testing work. Among the last-named, special mention should be made of the Union Sulphur Works, of 60 Stone Street, New York City, who donated to the citizens of the State of Pennsylvania, in co-operation with our Model Orchard Work, one carload of sulfur, in barrels.

13. THE NEEDS OF THE BUREAU AND RECOMMENDATIONS WHICH WILL INCREASE ITS EFFICIENCY.

One of the great burdens of the Division of Zoology has been the answering of thousands of questions on the subject of plant diseases, botany and horticulture. There is evidently great demand of the additional services of persons in these professions in this State. At State College our friends engage in such technical professions

are required to give much of their time to teaching and investigation, and would necessarily be tremendously burdened with any attempt to answer such volumes of inquiries on each subjects as have come to us; yet we have been obliged to refer inquiries to them, and thus, in many cases this delayed replies which were desired immediately. If this office of the Department of Agriculture were equipped with a plant pathologist, a botanist and a horticulturist, it would be of considerable value to the citizens of this Commonwealth.

Another serious need of this office is more room. At the present time some of the employees are working in rooms on the third floor, and others on the fifth floor of the Capital Building. If there were room that we could work together, the results would be far better. If arrangements could be made for another room on the third floor, near those now occupied by our office, the results would more than justify the effort.

Facilities for making definite experiments are needed, in the form of a plot of ground set aside for this purpose, and it is hoped that the next Legislature will see fit to appropriate money to buy a small tract that can be given to experiments. An insectary room, for keeping insects alive, and in normal conditions of temperature and moisture, continues to be the urgent need of this Division. It is earnestly hoped that this will be realized soon.

Additional help is most seriously needed in the form of a Recording Clerk, a Mailing Clerk and an Accountant and Assistant Stenographer. It would be far better if these were provided by definite legal enactment, rather than specially and only temporarily engaged.

Yours truly,

H. A. SURFACE,
Economic Zoologist.

**REPORT OF THE BUREAU OF CHEMISTRY FOR THE
YEAR 1909.**

JAMES W. KELLOGG, *Chief Chemist.*

The work of the Bureau of Chemistry for the year 1909 has consisted of a continuation of the work of previous years in the collection and analysis of samples of concentrated commercial feeding stuffs, Paris green and linseed oils and in the carrying out of the provisions of the respective laws which control and regulate the sale of these commodities, and also the analysis of a large number of special samples.

In addition to the laboratory work, we have answered a great many inquiries concerning the products analyzed, given information in regard to the estimation of feeding rations, carried on the work of keeping the court records incident to the court work, where prosecutions have been brought for the violation of the laws, and attending hearings as witnesses in such cases.

The Bureau has also had charge of the book-keeping in connection with the official end of the work and the publication of the bulletins or reports of the samples of materials analyzed and examined. We have been called upon to prepare an exhibit illustrating the work of the Bureau, which was shown at the annual meeting of the State Grange. This exhibit consisted largely of samples of feeding stuffs found on the markets of Pennsylvania and the ingredients entering into the same, including the many by-products and also some adulterants. The members in attendance at this meeting were interested in this exhibit and our work was thereby better illustrated and brought to their attention.

We have examined a large number of samples of different materials sent in by other Bureaus of the Department and offices of the different Departments of the State Government. During 1909, three hundred and thirty-one towns and cities were visited in all of the sixty-seven counties of the State, by an agent of this Bureau, and thirteen hundred and seven samples of feeding stuffs were collected and forwarded to the Chief Chemist. All of these samples were analyzed, chemically and microscopically, with one exception, and reports were made to the Secretary of Agriculture, to the manufacturers of the same and to the dealers from whom the samples were taken.

In order that manufacturers of and dealers in feeding stuffs doing business in Pennsylvania, may properly guarantee their feeds in compliance with the requirements of the law, a provision was made making it possible for such parties to have their feeds analyzed by this Bureau, for a small fee. As a result of this provision, three hundred and twelve samples have been received, analyzed and reports made in each case, on the results obtained. In connection with the analysis of these samples in many cases inquiries were made as to their comparative feeding value with other feeds and for the so-called feeding nutritive ratio, and in so far as possible this information was given.

In the examination of the official samples taken by our inspector, it is a pleasure to report that a marked improvement in the quality of these feeds over those of previous years was found to exist. This condition is clearly shown by the fact that during 1908, one hundred and

twenty-eight prosecutions were brought for adulteration, misbranding and improper labeling, and during the present year, only fifty-seven prosecutions were instituted.

The present feeding stuff law, which became effective August 1st, 1909, is considered by many to be far in advance of those in force in other states; as it prohibits the use of certain adulterants often used in feeds and limits the use of several by-products of little feeding value which may be used in feeds sold in this state. As a result of these prohibitions and restrictions, several feeds have been driven out of the markets of Pennsylvania, which contained rice hulls, ground peanut shucks, ground corn cobs, weed seeds, flax plant refuse and similar substances.

The law requires manufacturers of feeding stuffs upon the request of the Bureau, to register such feeds as are sold in this state. We have on file in this office the registration of three hundred and thirty-nine firms representing over eleven hundred brands of commercial feeding stuffs. These registrations give the analysis, and when a feed is composed of more than one ingredient, the list of ingredients or composition is given. Manufacturers of and dealers in feeding stuffs have shown a hearty co-operation with the Department in our work and in the majority of cases they have shown an earnest endeavor to comply with the requirements of the law. Many minor violations have been detected, owing to the fact that the parties involved were either careless in properly labelling or branding their feeds, or ignorant of the requirements; but as soon as these violations were brought to their attention, they were speedily corrected. Actual adulterations have been much less in number this year than during 1908. Only two samples were found which contained rice hulls, as against six samples during the previous year. Two samples of cottonseed feed were sold for cottonseed meal. Six samples of gluten feed contained cottonseed meal and ground corn cobs, and one sample was composed of gluten feed, cottonseed meal, ground peanut hulls and ground corn cobs. Three feeds were advertised to contain hominy, corn and oat feed, and upon examination were found to contain in addition to these ingredients mentioned, ground corn cobs and salt. Seven samples of oil meal were received which contained ground screenings or weed seeds. Three samples of ground flax screenings were labeled and sold in such a manner that they would be taken for flax meal or linseed meal. Nine samples of wheat middlings and three samples of wheat bran were found to be adulterated with ground corn cobs. Two wheat mixed feeds were also adulterated with ground corn cobs and one sample of wheat middlings contained corn meal. Two samples of wheat feed were labeled or advertised to contain "75 per cent. wheat bran and 25 per cent. other by-products." Upon examination, both these samples were found to be composed of wheat bran, ground peanut hulls and ground corn cob. In all of the above cases where adulterants were found to exist, prosecutions against the parties selling these feeds were brought and fines were imposed by the magistrate in each case. The number of deficiencies in protein and fat from these constituents as guaranteed, were few in number this year.

The results of the chemical and microscopical examination of these official samples of feeding stuffs have been compiled in bulletin form, and as soon as the reports are received from the hands of the printer, they will be distributed to about three thousand parties whose names are on our mailing list, consisting of manufacturers, dealers and those interested in the use of commercial feeding stuffs.

Our appropriation for the feeding stuff work was considerably diminished by the last session of the Legislature. This reduction of our finances is to be regretted, for if the feeding stuffs found upon the markets of Pennsylvania are to be improved in quality, it will be necessary to extend our work by covering more territory in the collection of samples and by the analysis of a larger number of the same. While we are doing an effective work in regulating the sale of feeding stuffs, it is possible to improve this work by having an additional inspector for certain times of the year, at least to assist in visiting the different sections of the state. The collection of a larger number of samples would probably mean an addition to the laboratory force. It is earnestly hoped that the next Legislature will be strongly urged to increase the appropriation for feeding stuffs work, in order that this Bureau may more effectively carry out the provisions of the law.

In carrying out the provisions of the Paris green law, our special agent collected five hundred samples of Paris green during the year 1909. These samples were all analyzed and with one exception were found to be of good quality. One sample was found to be adulterated with a starchy substance and prosecution was brought in this case. The results of the analyses were reported to the Secretary of Agriculture and to the manufacturers and dealers in each case. The Paris green law requires that this article shall be guaranteed to contain 50 per centum of arsenious oxide in combination with copper and not more than 3½ per centum of arsenious oxide in water soluble form. with two exceptions the green examined met these requirements.

The law also requires that each sample should be properly labeled with the guaranteed amounts for the ingredients mentioned in addition to the brand name and name and address of the manufacturer or importer. Many samples were found not so guaranteed, but when the proper parties were notified that the law was being violated, the necessary labels were at once attached to the packages containing the green. The results of the analyses of the samples received and analyzed have been compiled in bulletin form and will be distributed to dealers and manufacturers whose names are on our mailing list.

In the Linseed Oil work, our agent has collected throughout the State during 1909, two hundred and seventeen samples of raw and boiled linseed oil. All of these samples have been examined and ten of them were found to be adulterated with foreign oils, chiefly coal oil in varying amounts, from 4 to 25 per cent.

The analyses of oils received since the close of the year are being made and the indications are that several more samples will be found to be below standard and adulterated. In many cases these adulterated samples were found to be of decidedly inferior quality. This form of adulteration is of a serious nature, as linseed oil is largely used in the preparation and manufacture of paints. When the reports of these violations are made, the parties guilty of selling inferior grades of oil, will be prosecuted. As soon as the linseed oil work is completed, reports will be compiled and distributed to manufacturers and dealers.

Over six hundred miscellaneous special samples have been received and examined by the Bureau during the course of the year. A large proportion of these samples were milk, cream and butter sent in by the Dairy and Food Bureau, an assistant being paid by this Bureau for doing this work. The samples, not milk, cream or butter, consisted of feeding stuffs, by-products and a few miscellaneous materials

submitted by feed dealers and others interested in our work. Several of these samples were so called check samples analyzed by different chemists as well as by this Bureau, in order to check our work with that done in other laboratories. It is of interest to report that our analyses agreed remarkably close with those found by other chemists.

It has been previously mentioned that many special samples were submitted for analysis under the provisions of the Feeding Stuff law, and as a result of some of these analyses, we have been of assistance to many consumers in the settlement of claims between them and dealers and manufacturers for loss in money value where the analyses of feeds in question failed to meet their guarantees.

The office work of the Bureau of Chemistry has increased somewhat over that of last year. We have received about 2,000 letters in connection with our work, and many of these have been requests for copies of laws, bulletins, reports and other information. In so far as possible, these requests have been complied with. The bulletins or reports giving the results of analyses of products examined by us, have been compiled and such bulletins representing the work of the previous year, have been forwarded, together with copies of laws, to over three thousand manufacturers, dealers, etc. Circular letters were sent out to all manufacturers of feeding stuffs, requesting the same to register their feeds with this Bureau. The number of such registrations and the number of brands of feeding stuffs received have been previously stated.

A considerable portion of the Chief Chemist's time has been employed in attending court hearings and in keeping records of the finances of the Bureau, in addition to preparing reports.

It has been found necessary, owing to the large amount of correspondence and the work involved in the preparation of reports giving the results of analysis, etc., to employ extra help in order to relieve the stenographer. If our finances would permit, it would be advisable to employ an extra stenographer or clerk, for at least part of the time, to assist in the office work.

A few additions and improvements have been made to the laboratory. A new electric drying oven has been installed and the tops of the tables have been tiled, which not only adds to the general appearance of the laboratory, but protects the supplies stored in the drawers and cupboards from damage by leakage of water and acids.

It is a pleasure to report that all those connected with the Bureau have faithfully performed their duties, and to all many thanks are due for their support in the carrying on of our work. Many thanks are especially due to the Secretary of Agriculture for the many courtesies and advice received and also to our general agent, Mr. G. G. Hutchison for the advise and effective manner in which he has assisted us in our work. Thanks are also due to Prof. F. D. Fuller, formerly Chief Chemist of the Department, who, before severing his connection with us early in the year, was of great assistance to the present incumbent in assuming the duties involved in carrying on the work of the Bureau. Our special agents, Mr. Stiteler and Mr. St. Clair have been especially faithful in the performance of their duties in the collection of samples.

It is to be hoped that in the coming year we will be of greater service to the Commonwealth in the enforcement of the laws with which we are charged, than we have been during the year just closed.

**PAPERS READ AND ADDRESSES DELIVERED AT THE
ANNUAL MEETING OF THE FARMERS NORMAL IN-
STITUTE, HELD AT YORK, PA., MAY 25-28, 1909.**

ADDRESS OF WELCOME.

By HON. J. W. BITTINGER, Judge of the Courts, York, Pa.

Mr. Chairman, Members of the Agricultural Association, and Farmers' Institute: I was asked this morning to come here and meet you on this occasion as an official of the county, and express to you a welcome to our midst, in the absence of several officials who expected to do that duty, but who were unexpectedly called away from the city. You will, therefore, have to bear with me in some extemporaneous remarks. I have not been able to prepare anything for this occasion, and will have to depend entirely on extemporaneous speech.

The Farmers' Institute is a thing of great interest. All wealth comes from the earth, which was created for man, who was prepared to enjoy it. All wealth must come from the soil either from the farmer tilling it or from the minerals that are dug out of it and are the means of creating wealth. When it is procured in that way, it is destroyed, while the betterment of life and business and humanity depends upon its preservation. Farming goes back to the earliest history. We read of tillers of the soil before we learn of anything else. In the earliest days the people tilled the soil, and we read of the sections that they opened up. The creating of laws in the interest of any principality was at once applied to the farmers as the creators of wealth. Now, in this country it has been ever since the beginning of the country, the principal matter. It was the early efforts of the farmers, who cleared out the forests and turned them into farms, that built our schoolhouses and churches and introduced civilization and planted it and sustained it. They have been, since

be properly conserved by placing a proper man in the place. I have had the pleasure of meeting Secretary Wilson, who has served under four Presidents—three Presidents—McKinley, Roosevelt, and the present Executive. I found him to be a thoroughly practical man, who was not only a farmer by theory, but by practice as well, out in the State of Iowa, where he has large farming interests. He is an excellent example of the right man in the right place, and will, doubtless, if he lives, be called to a higher place. I found him to be not only a thoroughly practical farmer, but a man of wonderful mind in other directions. He was able to repeat from memory all the psalms which he had learned in Scotland when a boy. He is not only a good farmer, but a good Christian. We all feel an interest in farming, and most of us feel an interest in religion. Any man, no matter whether he is a manufacturer or farmer, should feel an interest in the religion of his country.

Now, it is a great thing to have such a gathering as this in our midst. You represent the farming interests of this great State of Pennsylvania—the Keystone State. It is a great mining and manufacturing State, but it must not be overlooked that the sub-strata in Pennsylvania is nevertheless the farming interest. It will remain so. Our great population must be fed and provided for, and this comes from the farm. Everything that tends to benefit the farmer advances the city. It gives me great pleasure to see you here. The Governor is not here, but he is the President of the organization, and you have honorable and responsible men to fill the other offices. You come here from every section of the State as it appears from the newspaper, which I read this morning, from the far east and the north and the west, and with such an organization you must be a body of great power, and you must congratulate yourselves upon your great work, and the people of York must congratulate themselves that you are here with your wives and your daughters to further the objects of this organization.

Great improvements have been made in the conditions of the farm. We not only have a Department at Washington, but also in the State of Pennsylvania, with proper officers whose duty it is to further the interest of the farm, and the farm home, and the methods of farming of the people engaged in this great enterprise of tilling the soil, and holding the balance of trade in favor of this country. We have not only fed our own people at home, but we largely feed the civilization of the world: our exports largely exceed our imports. Great achievements have been made. There have been improvements to the tax laws, but they are not yet perfect. There is an impression, often, that by the laws as they are today, there is no tax on real estate, but that is a mistake; the county collects the tax and hands it over to the State. There is room for improvement there. There is room for improvement in the educational laws of this State. Room for improvement in the morality of the citizenship of the State. There has been great improvement in the character of farming, and in the character of the farmer, but there is room for still more improvement. There is room for improvement, also, in many other respects. Equal taxation, as I said, and in legislative matters. Legislatures frequently pass laws that are of no good to the people, and fail to pass laws that would be of vital benefit to them. If we could always send to the Legislature such men as Senator Brown of this county, whom you all remem-

ber, there would not be much trouble in that respect. You want to see that proper men are elected to official positions, and then give them a little jogging once in a while after they get there to see that they do their duty. If the farmers make proper demands upon Congress, and upon the Legislature, and upon the Governor, they must be recognized. They are in position to enforce legislation; they have already accomplished much, and with proper and united effort can accomplish much more for the interest of the farm and the home. When you meet in such a body, the people see your strength, and begin to take an interest in your work, and to sympathize with it, and if you attend to your duty at election, and elect the proper men, you will win.

York is a great county; we have fine lands and fertile fields, and intelligent men who till them. These men have intelligent wives to look after their interests, and to see that their children are properly clothed, and get to school and to church on the Sabbath day. The presence of ladies on such an occasion as this shows that they are always ready to do their duty. The world does not suffer for want of proper effort on the part of our better halves. The women are always at the head of every matter of interest, and are always ready to do their best in behalf of every good cause and to suffer, when it is necessary, on behalf of men and women.

Now, I have detained you longer than I intended. I intended to call your attention to the matter of the preservation of the forests. I know you are all interested in that. In these days, when so many places are drying up, we don't want the forests to be cut down. They are being cut down everywhere. People are at work in this county cutting down trees, marking the wood, and so on, and we all know that we must have moist soil to produce the crops, and to have moist soil, we must have trees to conserve the moisture. We cannot afford to have our crops parched, therefore it is necessary for us all to get together and get the public interested in this question of forestry. Of course, there are some trees being planted, but it takes a long time for them to grow up, and they are being destroyed more rapidly than they are being planted.

I have some sympathy with the farmer. I was raised on a farm, and stayed there until I was seventeen years old. Some of you may think that is a very early age to leave the farm, but I have some very distinct recollections of clearing time where young hickory had been planted. I got a good many kicks on the shins in trying to use the scythe and in plowing; it nearly broke my back to use the scythe, but I could cradle with the rest of them. I remember how I used

I was telling one of my friends at the club the other day that I thought the agriculturists as a class were prosperous, and he told me I was mistaken; the agriculturists were not making any money; the farmers were prosperous enough; the farmers, he explained, were the men who worked with their heads and their hands, and they were making money; but the agriculturists were the men who lived in the city, and let some one else do their farming, and they were not doing so well.

We are a great manufacturing city; we make everything here from a suspender up to the best farm implements which are shipped to all parts of the world. I am told that the very best manufacturers are boys who were raised on the farm and then went to the city. The two interests work together; the farmer brings his crops into the city, and feeds us, and buys the implements that the city makes to facilitate his farming. So this is a mixed community, and there is entire harmony between the farmers and business men. They work in unison. They could not live without each other. At least, they could not live so well. They are prospering and making progress, and in their behalf I extend to this distinguished body a hearty welcome to our county and city on this occasion. We fully appreciate the great honor you have paid us by coming here and discussing your problems, and we hope that while your stay amongst us may be pleasant, our community, in turn, will derive some benefit from your discussions. On behalf of the city and county of York, I extend to you a cordial welcome, and wish you a successful meeting amongst us.

RESPONSE TO THE ADDRESS OF WELCOME.

By HON A. L. MARTIN, *Deputy Secretary of Agriculture, Harrisburg.*

Mr. Chairman and Friends: When we received the invitation to hold our Annual Normal Institute in the city of York, I felt confident that we were entering at least into a county that was widely known throughout the State as an up-to-date agricultural county. I also knew that our convention would be held in a city that was known far and wide as a great manufacturing city, a city second to none in the United States as a manufacturer of farm implements, hence we had every reason to believe we would be made welcome. Indeed, when coming here on the early morning train, we were met at the station and invited to visit certain farms certain manufacturing plants, and other institutions. And since this session opened, I was personally called upon by the Sheriff of the county and invited into the building on the other side of this room, so that I feel confident, after having listened to this warm and excellent address of welcome, coming from so high a source, speaking in such terms of praise and commendation for the occupation we represent this afternoon, we not only feel doubly welcome but that our occupation has been honored by listening to that address.

And now, my friends, it only remains for me to offer a few scattering remarks relative to the work we represent—the work of this organization. Before doing so, however, it would be doing violence

to my feelings should I fail to speak of one or two men with whom I early became acquainted, from the county of York. The gentleman who made the address of welcome referred to the Hon. Jere. Brown. I need only speak that name to recall to other members of the State Board the earnest efforts of the Hon. Jere. Brown to advance agriculture. I met him in the Senate about fifteen years ago; he was then chairman of the County Institutes of York, and I well remember his tireless, vigorous, earnest efforts to elevate the agriculture in the State. In the Legislature he was a power; in the county he was held in high esteem, and in the home life he was an example of the higher and better life.

Sometimes the question comes to my mind: what of the work? What have we accomplished? What one of you acquainted with agriculture in the last two decades but could show me, and mark out the progress accomplished in the last twenty years in agriculture. Do you realize that there has been a revolution in farming in Pennsylvania in the last ten years? But again you ask, what have you done for this progress? The organization you represent today is the one organization that comes face to face with farming in Pennsylvania; that has its sleeves rolled up. It is the burden of our effort to bring to the farmer of Pennsylvania the best methods to adopt in every line of agriculture. How well we have accomplished that can be best shown by turning to the results. The Scriptures tell us, my friends, that "by their fruits ye shall know them." Today, in Pennsylvania, largely as the result of the teachings of this organization of Farmers' Institutes, there are more than ten thousand silos for the more economic feeding of the dairy cow. There have been eliminated from the dairy herds of Pennsylvania more than fifty thousand cows that were unprofitable—largely as the result of the teaching of the Farmers' Institute. There are more than five hundred thousand farmers in Pennsylvania today who are measuring and dividing out the feed of that dairy cow, and studying how she may more economically bring results from that feed. And, my friends, we can go through the entire list of farm proceedings in the same way. The same thing holds true in horticulture. Do you know that in horticulture, growing and pruning trees is revolutionized today—due, I believe, largely to the efforts of my friend here on the left, Dr. Funk, whose book you have read—not altogether, but largely so, and also through the sound teaching that has been preached along this line for the last twenty-five years?

It might be interesting to some of you to know something of the work of the Farmers' Institutes this year, and you will pardon me if I read you just a few figures that are so slow to remain in my mind. They are something to be proud of—our Institute organizations in Pennsylvania—proud of for two or three reasons. This organization brings to the front a number of the best men and women engaged in agriculture all over the State. Our County Chairmen of Institutes—most of you represent this afternoon; I would be proud to have you photographed and placed in the gallery of the best institutions of the world, and your names written there, for your work throughout the counties of Pennsylvania—work done faithfully and voluntarily and without recompense. We have reason to be proud of you. Then, it has been a part of my work for the past twelve years to draw from other states, as well as our own, men and women qualified to take up this work and impart methods of instruction

in practical and scientific farming to the farmers of the State. We can feel proud that Pennsylvania is provided with a corps of lecturers than whom there is none better in any state in the Union, and constantly, from year to year, have other states, adjoining and farther off, draw from Pennsylvania their most efficient Institute workers.

And now, my friends, you may be somewhat interested in a few figures. Last year there were held in Pennsylvania 203 institutes—twenty-four one-day—one hundred and seventy-two, two-day, and seven of three days or more. In these seven of three days or more there were four movable institute schools. These schools were held in McKean, Erie, Crawford, and one other county—Columbia. I want to stop to say a word in regard to these movable schools as an advance institute work. In the town of Bloomsburg, in Columbia county, we started in with one early in the winter, the farmers at the very first session of that school. We held three sessions a day. It was not my privilege to remain the week there, but I learned that at every session there was an increased attendance, and increased interest. Three distinct topics were discussed daily—dairy interests, judging and scoring cattle, the proper feed, and so on, all illustrated; then a session in horticulture, including spraying, grafting, pruning, and so on; then the poultry interest was taken up, and it was an inspiration to see the deep interest manifested by the farmers of Columbia county. The same was true in Crawford, McKean and Erie, and in the city of Erie, with some 70,000 population, the Board of Trade rooms were thrown open to us, and there we had four days of this kind of work, the farmers coming in from all sections of the county, in spite of the severity of the weather in the northwestern part of the State. I simply throw out these thoughts in order that we may develop in Pennsylvania the best means of meeting this demand of the farmer, for demonstration as well as talking. In these institutes of three days or more, we held twenty-three days of meeting during that time. Last year we had an entire number of 982 sessions, at which the total attendance was 156,652. Employed in this work were 73 State lecturers, and 221 local lecturers.

Permit me to say a word in reference to these local institute lectures, in which the local organization where these institutes are to be held, and the people of the county and vicinity are always invited to go on the platform and take part in the discussion, and read papers, and join with the State lecturers in developing this great question. Now, in order to bring to your mind how these local people help us, I would say that we had 221 local lecturers who volunteered to help our State lecturers. The total cost of holding these institutes, which includes car-fare, hotel bills, hall hire, etc., was \$38 per day for the entire season. Indeed, my friends, that little report shows better than in any other state in the Union. Just here I want to say something and commend a little. In many of the counties of the State the people were so anxious to have these meetings that they threw open their churches to us and practically all the cost to us, except for light and heat, was a slight remuneration for the janitor. Indeed, if it had not been for the liberality of the members in many of the counties of the State we would have been without a place of meeting in some of the smaller places where they have no halls. And I may say that our effort has been to help sustain the teaching, and the character on the part of the instructors that will comport in moral standing with the highest ideal. Especially does this apply

to the farming people of Pennsylvania and their churches. Are they not sustained, and do they not receive their support, as well as largely their spiritual strength, from the men who are engaged in farming in their midst? Why should they not open their house of worship for this great work of agricultural education and advancement?

Besides these regular institutes, we had a number of independent institutes—some fifteen were held in the State for which we supplied one or more lecturers, and at which the total attendance was 29,000. At our last Normal Institute 1,900 were in attendance, so that we have had for the entire year ending with the round-up meeting for 1909, a total attendance at our institutes of 187,550 people.

We have in Pennsylvania about a million people interested in agriculture. We have not reached them all yet. Indeed, my friends, there are people in every county of the State asking for institutes, which we have neither the means nor the power to supply at this time, although the legislature has given us careful consideration in the way of appropriations. It is very rarely, indeed, that we have gone before that body, and asked for an increased appropriation that it has not been granted us. We have not been restricted. During the last session of the Legislature, we intended to ask an increase of \$10,000, indeed, your Resolutions for the past two years were to that effect. In appearing before these Legislative bodies—and I want to commend our good Secretary to the right who opened the way for me to appear before these bodies and state the case. Through the efforts of those interested, the Legislature increased our appropriation, making it \$45,000 for two years, or \$23,500 per year to help us in our great Institute work.

Now, my friends, I have already talked too long. I am satisfied that every one of you here fully appreciate your opportunities, and the importance of the work in which you are engaged. We have to meet the farmers of Pennsylvania on their own ground; it is our work to advise them how to increase their acreage, and the average yield of their crops; how to make the best use of the best methods. Before I take my seat may I call your attention to just one or two of the products of Pennsylvania. You know there are many people who say that Pennsylvania is a great manufacturing state—the greatest manufacturing state in the Union. And so it is. She is the greatest mining state in the Union, but she is, at the same time, one of the greatest farming states. In order to bring this matter to your mind more forcibly, let me give you some statistics. It is a part of my work to tabulate the farm products and their selling prices in Pennsylvania. Very interesting they are, but I have only time to give you one or two of them before I take my seat. Now last year Pennsylvania raised of

	Acre.	Bushels.	Price.
Potatoes,	261,000	23,968,000	\$15,389,000
Wheat,	1,618,000	30,065,000	28,591,000
Corn,	1,413,000	45,922,000	29,390,000

The point to which I want to call your attention is this; we had a great potato crop last year, but how many farmers, do you suppose, raised 200 bushels to the acre? Or even 100? No; no. If I were to ask you how many of you raised 100 bushels, I might get some answers, because you are Farmers' Institute men, but what was the average? Just 88 bushels per acre, and Pennsylvania is not a great potato state, either. The average farmer in Pennsylvania is a mighty poor farmer. How many of you could easily have raised ten more bushels per acre; you could do that, and if you increased your bushels from 80 to 90, it would make a difference of \$18,392.00 dollars. Now, to what end is the Farmers' Institute of Pennsylvania devoted? It should be devoted to teaching the farmer—that is the average farmer; he is the fellow you want to reach—the methods of selecting his seed, of preparing the soil, of cultivating that land, so that instead of 88 bushels per acre, he will have 150 bushels; there is nothing extraordinary about that. Many are growing 300 bushels per acre, and then they wonder what the other fellow must be growing to bring the average only 88 bushels. What we want to do is to awaken the mind of the sluggish farmer of the State, and get him to thinking, and to working along improved lines; get him interested in the Institute; he is the man we are trying to reach.

The same thing holds true of corn; we are a splendid corn state; we grow 4 bushels per acre more than the leading corn growing states in the Union, but even then, my friends, how many bushels to the acre do you grow? How many do you fellows in York county grow? You grow corn here, but how many bushels do you grow to the acre? Less than thirty-eight bushels per acre! Now, just a little raise up to forty bushels will raise the average. We cannot expect to largely increase that average yield in one, three, or even five years, but by constant improvement, raising the average a little at a time, we can raise the average yield of Pennsylvania up to 50 bushels per acre without any trouble. To this end the members of this organization go out and meet the farmer face to face, and look him in the eye, and stand shoulder to shoulder, working for the best method of developing a higher standard of agriculture in Pennsylvania—the best method of increasing the working power of the farm; the farmer has to make his living out of it, these are vital, living questions to him. My fellow-farmers! the Institutes of Pennsylvania stand for investigation and development. Time will not permit me to speak of the great educational force that is now at work, working out and leavening for the farmer of Pennsylvania some of the problems that confront him. Normal schools were organized for preparing teachers, to which we have the right to look for the development of our young men and women, and they are now waking up at the eleventh hour. Thank the Lord for that even if it is at the eleventh hour. Some of them are beginning to place in their course of study, agriculture, and agriculture will keep its place in the front rank by reason of its importance. Up to this time the boys and girls who are going to run our farms have only had occasion to develop their minds along the lines of commercial enterprise, soil and mineralogy, and botany and chemistry, as applied to the soil, were all neglected. But agriculture is now coming into its own. All sections of the State are now looking in that direction, and we shall turn out farmers and fit our boys and girls to take our places in the field when we lay down our work in these Farmers' Institutes.

SOIL CONSERVATION OR NATURE'S METHOD OF MAINTAINING SOIL FERTILITY.

By FRANKLIN MENGES, PH. D., York, Pa.

Soil conservation, or the maintenance of soil fertility, is the foremost question of the day, and the best way to maintain this fertility should be made so prominent by Farmers' Institute Lecturers, by Agricultural Experiment Stations, and National and State Departments of Agriculture, that the farmer will awaken to see its importance, and be induced to introduce methods by means of which this fertility can be maintained, and to demand both National and State legislation of such a character, that this one National resource, of all resources the most important, shall be handed down to posterity for the perpetuation of the states and nation, unsullied in any of its capacities.

The maintenance of soil fertility is, therefore, a National question. While it did not receive the consideration and occupy the foremost position, as in my humble opinion it should have done, at the National Conservation Conference, called at Washington, May 13th to the 15th, 1908, by President Roosevelt, for the consideration of feasible methods for the preservation of our National resources, yet there was at least one member of that conference who was far-sighted enough to see that the maintenance of the fertility of our soils was "the issue of National existence."

Men must be taught to realize their duty to coming generations. In a monarchy, the conservation movement may be the dictum of one individual, or the policy of an autocracy, but in a Republic like ours, it must be made the policy of the whole people. Do the people realize, or do the farmers see, that the fertility they are now consuming, and not returning to the soil, came to them from the hands of nature, built up through ages of time, which became more fertile, the longer she kept on building? And do the people see that man has come in, and has arrayed himself against the processes of nature, and has become an agent of destruction, instead of an agent of construction? With nature's method of crop production she developed soils that became so fertile that they were capable of producing such crops that it was no longer a question for these crops to obtain fertility from the soil, but sunlight, and only those that had developed the power to raise their heads above their competitors into the eternal ocean of sunlight could survive. But not satisfied with this attainment, nature produced the shade-enduring varieties of trees and bushes, and in large areas of our forests, we have the towering oak, and the undergrowth into which hardly a ray of sunlight penetrates.

In the words of another, I want to say "Earth is a potential forest." Given time, freedom from geological revolutions, and from interference by man, tree growth must finally dominate every thing, with but few exceptions. The causes of this domination of tree growth are their perennial nature, their height above all other vegetation, their remarkable recuperative powers, their annual pro-

duction of reproductive seed and spores, but still more, the production of the annual ring of new wood in stem expansion and root development for feeding this new wood. The central part of the tree may decay, but so long as the annual ring is added, unless something else interferes, the tree survives, and under these conditions, it seems it would never die of old age. This endowment of self preservation and perpetuation seems to have characterized forest growth during the geologic ages, in which the earth supported life, because it seems that forests had then gained possession of the earth's surface.

Already during the Devonian age, when but a small part of the continent had emerged, the mud flats and sand reefs became clad with pioneer forests, composed of tree rushes, Calamites, Lepidodendrons, Sigillaria and the prototype of our pine, the Dadoxylon. During the Carboniferous age, when there must already have been a good soil, these and many other forms became more numerous, and lightly spread over all the land and formed our coal beds. During subsequent geological ages many floral types vanished completely, and others of a higher character appeared, until there were species adapted to all sorts of conditions, capable of climbing the steep mountain sides and covering the land with forests to the poles. In more recent times came the leveling process and the period of glaciation, which introduced such climatic changes that only the hardier races survived, and these were driven south in a rout.

When this glacial winter receded, the harder species of the pre-glacial forest which had been so precipitously driven south, again made battle for possession of the soil and followed the northward movement of the receding glacier until the forest again covered the earth to glacial limits.

The forests which at one time covered this country from Maine to the Gulf, and well-nigh from the Atlantic to the Pacific, was the result of the last struggle.

With this virgin forest, the creation of long-continued evolutionary changes in species, changes in the surface of the earth, changes in climatic conditions, changes by volcanic eruptions, nature handed over a soil to man, when the world was ready for his occupancy, which she had created out of disintegrated rock and organic matter, a soil that was capable of producing larger and larger crops as ages passed on. As the forest contested for, and finally gained complete possession of the soil during geologic ages, so does it become the victor to-day, unless interfered with by the hand of man.

As during early geologic ages, when but small areas of land existed, only the lower forms of plant life could thrive, so to-day on the naked, but partially water decomposed surface of the rock, and on the coarse stony mountain sides, and on the rounded gravels and selicious sandy deposits or rivers and oceans, as well as on the hot, dry plains, the preliminary work of the lower vegetation, such as the algae, the lichens, the mosses, the grasses, herbs and shrubs proceed to cultivate the naked rock and stony mountain side and coarse gravel and selicious sands of rivers and oceans, and lay down their bodies a sacrifice on the altar of soil creation.

By this sacrifice of themselves these pioneer soil makers through centuries of time accumulated sufficient depth of soil for the first tree formers to appear.

In the Appalachian Mountain system, the members of the Heath family, such as the Laurel, the Rhododendron, the Ground Laurel, the Trailing Arbutus, are the first tree forms to appear. After these comes the Viburnum, then the Wild Cherry, all of which to-day, where the forests have been cut and burned away, again and again, strive to cover the parched hill and mountain side, with grateful shade, which the greed, the avarice, the viciousness of man denuded and scaled. Along the water courses in this section the alders and willows soon take possession and where the soil has accumulated to sufficient depth, they become so persistent as to crowd even the flowing water into narrower channels and hold up the soil that comes down from the hill and mountain sides. Following these pioneer trees come the pine and spruce, satisfied with the scanty soil and soil moisture of the mountain sides, while in still higher, colder and wetter elevations, the fir, sometimes much stunted by the rigor of its environment, thrives.

These trees, with their congenial shade, prevent the evaporation of water from the scanty soil, and their falling and decaying foliage increases the soil depth, helps the decomposition of the rock and greatly increases the water-holding capacity of the shallow soil. After the pines and spruces came the birch, the maple, the elm, and the ash, and in the moister and more fertile places, the oak—first the chestnut oak, then the black oak, and a little later the white oak, and the assiduous hickory, and the beeches and other shade enduring species. All of these have worked together century after century, creating a foot of soil during every three to five hundred years, by the decay of leaves, branches, and the bodies of those that have fallen by the way in the intense struggle. In this way a soil of such depth and fertility was produced, that the contention of the trees was no longer one for fertility, but a struggle for sunlight.

ATMOSPHERIC DISINTEGRATION OF ROCK.

The atmospheric disintegration of rock has already been referred to. It is supposed if the formation of the soil depended entirely on this method of production, that a foot of soil would be made in about ten thousand years, or a soil four feet deep made in this way would require forty thousand years. If this is true, then the decomposition of the rock and stones in our soils must proceed very slowly, and the mineral fertility these contain made available in exceedingly small quantities. But where the two are combined, the forest and the atmospheric agencies, the one taking the mineral fertility out of the soil as it is made available, as well as helping to make it available, and combining it with the carbon and oxygen

the grasses, the pioneer trees, and the pines and spruces, the birch, the maple, the elm, and the oak, and produced a soil with ever-increasing fertility that knows no exhaustion.

DESTRUCTION.

Man now comes on the stage, and takes sides against the forests, and contends for the use of the soil, for the production of the crops needed for the support of himself and those dependent upon him, as well as for the use of the wood for the construction of his dwelling and the many thousand purposes to which it can be applied. A legitimate contention, had it stopped here, but when the crop yields from this virgin soil came, and the markets for these opened, and the many uses for wood in the arts developed, it so sharpened the appetite of man's avarice that he resorted to wanton destruction of the forests, instead of their legitimate use. But what is still worse, he has so interfered with the processes of nature that he set in operation the destruction of that instrumentality, with the exception of the soul and mind of man, the most important, the God-given soil, which under the constructive hand of nature required thousands of years to bring into existence. This he has brought about by parching the denuded mountain and hill-sides again and again with fire and thus destroying the pioneer soil-makers and handed over the naked rock and soil to the action of wind and water. He has dried up the bubbling spring at the foot of hills and mountains, and has deprived the streams and rivers, as well as the agriculture of the plains, of a constant water supply, which the forest-covered hills and mountains alone can provide. Within historic times in the mountain districts of France, by the wanton destruction of the forests, by the fire brand and browsing cattle, the soils were so despoiled of their vegetation and their vegetable matter that to-day only the bare rock stands out in the burning sun, where once luxuriant forest grew. But with the removal of the soil of the mountains by the torrents of rain, came the covering over the fertile plains of many thousand toiling farmers.

To-day, in order to prevent the further covering up of the fertile fields of these plains, an effort is made to reforest these bare mountain sides by building facines and stone walls and changing the course of the mountain streams into a succession of gentle slopes and by carrying soil to the mountain tops and planting quickly sprouting and growing trees to create natural barriers to prevent washing, and on the bare rock make a new soil through the same agency by which nature made soils at the first. Centuries of time will pass on before a new soil will again be built upon these naked mountain sides. The question naturally arises, can man be a conservator of the soil?

CONSERVATION.

Looking at nature's methods for suggestion for soil conservation, we notice that we still have about all the plant life that helped to create the soil, adapted to all the functions that called it into existence. But these do not provide food, and with the exception of the forests do not bring a monetary return to the farmer. Forests have been a wonderful agent in construction and still are, and are

valuable as well, and their preservation must be demanded by the people, whether lumber is on the free list or not. The higher elevations, from whence washing begins, must be re-forested in a systematic way. It may be objected that the forest trees do not supply the necessities of life, and there is not enough rolling and level land upon which to raise the cereals needed to supply the demands of the people.

To meet this demand, and at the same time conserve the soil, nature has provided many forms of nut and fruit trees, and berry bearing bushes and vines, as well adapted to soil creation and conservation as the forests, and which, if they had been brought under cultivation as have the cereals, would be as desirable as food for man. It is to be hoped that they will be brought under cultivation and that the Scientific Experts of our Experiment Stations and our National and State Departments of Agriculture, by modern methods of cross-pollination, fertilization and selection, may evolve nuts and fruits that can be raised on hill and mountain sides, which shall be as well adapted to supply the needs of the human body as are the cereal grains, and which can be made to yield larger returns than the grains.

THE FARMER AS A CONSERVATOR.

It was through the agency of leaves, largely, of the forest trees, that the two principal substances that make up the soil were brought together. The leaf extracted from the air the carbonic acid, elaborated from it the substances out of which wood is made. The leaf withered and died, and fell to the ground and added its body to the soil, and finally the tree did the same. This same cycle is going on on the farm, and as nature by a similar cycle has built soils that became richer and richer, so should the farmer. The question naturally comes up, how can the average farmer make a living off his farm, and at the same time increase the fertility of his soil? If there is one man who is trying to do something for that average farmer, I am at least trying to be that man. It seems to me, that average farmers should be made to know something of the long time required to construct such a soil as he is farming; how it came into existence; that it is composed of disintegrated rock and organic matter; that the organic matter is being obtained from the air, through the agencies of the leaves of the plants he produces, and that the wasting of this organic matter, or the burning out, or farming out the organic matter, is the main cause of the decrease of the fertility of his soils.

Get the farmer to see this, and see it clearly, then whether he

I have in mind several farmers living not a hundred miles from this place who were unwilling to change the old rotation, but who fully understand the importance of keeping up this organic matter in their soils. These farmers applied the manure to the soil directly as it was made, so that there was no loss there in organic matter or fertility. Beginning with corn in this rotation, crimson clover is sown at the last cultivation, which at the present time, after a practice of this sort of a number of years, always catches and winters all right. The crimson clover is plowed down in the spring and the ground sown with oats. Sometimes part of the field is planted with corn a second time, which gives the crimson clover a longer season to grow. With the oats is sown one of the clovers, either Red, Alsike, Mammoth, and Crimson has been used, depending somewhat on the price of seed. The growth of these clovers is such after some years of this kind of practice, that they interfere with the harvesting of the oats, as well as the drying. The clover is plowed down sometime after the middle of August, and the soil prepared for wheat. No grass seed is sown this time but in the spring, sometime in April, red clover is sown into the wheat. The clover seed is covered by running a weeder over the ground, which does not injure the wheat. After the wheat is harvested, the clover has possession of the soil, and this soil, by the raising of these clovers has become so fertile, that a crop of clover hay is harvested early in September, the clover sod plowed down, the field sown with rye and winter vetches, which are plowed down the following spring, and the field planted with corn. The rotation has been shortened one year, and with every crop produced, a crop of clover was raised and plowed down, and the only additional work and expense has been one plowing and the clover seed.

A farmer who has worked out a scheme like this will not stop here. He has now come into harmony with nature. He is constructive in his methods, and must make a living at the same time. He sees that nature has made the animal to feed on the land, and he has observed that the fertility of the soil can be maintained by feeding the crops raised on the soil to animals, return the excreta directly to the soil, and sell the animal or its products. Instead of plowing down the rye and winter vetch, he cuts them, silos them, or feeds them as soiling crops. Instead of selling the corn, he feeds it to cattle or dairy cows with the rye and winter vetch roughage. He feeds the oats also. Instead of selling the wheat, he goes into the co-operative movement, gets it ground, sells the flour, which contains the least fertility, directly to the consumers, keeps the bran and middlings and feeds these with the corn to balance the ration.

He is not a big fish, but simply the average farmer, who has come into harmony with the processes of nature, and is working along the lines to establish a permanent agriculture.

COMMERCIAL FERTILIZERS.

There are some soils, which, even through all the organic matter they produce, and the fertility it contains, is returned to them, are naturally so deficient in one or two of the elements of fertility, that an application of these elements pays. The farmer who works for a permanent agriculture, will be so well acquainted with his

soil, that he will use only that element in which he knows his soil is deficient, which will be one or both, Potash and Phosphoric Acid; for the Nitrogen he will have the clovers and the Nitrogen absorbing bacteria in the soil procure for him from the air. This farmer has observed that soils which contain a large amount of organic matter and a fair quantity of Carbonate of Lime, and have a slight protection of organic matter, or a growth of the green-blue algae, become richer in nitrogen even if there are no clovers growing upon them.

Hall observed in two fields at Rothamstead, abandoned to themselves for twenty-two years, that the one, the Broadbalk field, rich in organic matter and Carbonate of Lime, gained 100 pounds of nitrogen annually, while the other, the Greencroft field, not so rich in Carbonate of Lime, gained twenty-five pounds per annum. The farmer who works for a permanent agriculture, or for soil conservation, does not only employ the leaves of the plants to obtain organic matter from the air to keep up soil conservation, but he creates a congenial environment in that soil for the development of beneficial bacterial life, as well as for the maintenance of soil moisture for the dissolving of soil fertility, as well as to bring from depth beyond the reach of the plant root, by capillary action, the fertility washed, or made available there.

SOIL MOISTURE.

By PROF. CHARLES F. SHAW, *State College, Pa.*

I have just come from Washington, where I have been with a class of students, and I am very tired, but I will try to talk to you a little while on "Soil Moisture."

Soil moisture is closely related to soil fertility, on which you have just heard such an excellent address. Now, the plant must take its food in form of a solution. It cannot take solid food; it must have liquid food. It must have water in such a form that it can take it up. Now, the importance of soil fertility and soil moisture can be seen, when we consider for a moment the amount of money that our Government is spending in the reclamation service,—in digging canals and ditches for irrigation, and when the water is put on that land, they have a regular paradise, instead of the dry sage-brush they had before. The soil is there, and the plant food is there, but there is no moisture in the soil, and the plant cannot thrive. In the semi-arid regions of Western Kansas, Texas and the Dakotas, the farmers cultivate their land only once every two years in order to get one crop—in order that they may have sufficient moisture to grow one crop. But if we consider the matter of our drouths and the loss of moisture, and consequent loss of crops, we will find that this subject of soil moisture is just as important to the Pennsylvania farmer, as it is to the farmers of the semi-arid regions of the West. Every year they lose a large amount of

their crops through these small drouths that come once or twice or three times in a season, and that loss is greater than the loss that comes through the great drouths that come once every four, five, six, or ten years.

In the United States there were in 1908 approximately 100,000,000 acres of corn. Now, it would not take very much drouth to cut down the yield one bushel per acre, but if we do that, we cut it down for the country 100,000,000 bushels, at, say 50 cents per bushel. That bushel per acre would reduce the money in the farmers pockets in Pennsylvania \$70,600 in one year, and the farmers could not afford that. Now, if the land was properly cultivated, that water could be saved and used.

Water in the soil has three great uses; it is first, a plant food; and the first chart I will show you gives you the percentage of water in the different plants, and shows you the amount of water that goes into them:

Timothy (green), 70 per cent. water.

Timothy (dry hay), 14 per cent. water.

Clover (green), 80 per cent. water.

Clover (dry hay), 16 per cent. water.

Alfalfa (green), 74 per cent. water.

Alfalfa (dry hay), 16 per cent. water.

Potatoes (in tubes and roots), 75 per cent. water.

Potatoes (in the leaves and stems), 90 per cent. water.

Apples and pears, 83 per cent. water.

Strawberries, 90 per cent. water.

That shows you the amount of water that is needed for food. That grows in the plant just the same as the water in our own bodies does, as a part of our being.

Now, that is the first use. The second use is as a dissolver of plant food. As I said before, the food must be dissolved in order to get into the plant.

The third use: We must have water to carry that food up into the leaves of the plant, where it can be used. The water is also needed there in the little cells to keep the plant turgid and stiff. When the plant begins to wilt, the water is leaving the cell. In the case of corn, the cells on the inside of the leaf begin to evaporate more rapidly; when the leaves begin to curl up, they reduce the evaporation by one-half, so that when the corn leaf is curled up, it is trying to save moisture.

Now, the water can only come from one source. It comes down by precipitation in the form of rain. The water is drawn up from our great rivers, from our soils, and from the oceans, and then precipitated in the form of rain. Our average rainfall in Pennsylvania is about 40 inches annually. It varies from 43 inches in south Bedford Co.; to as little as 32 inches in some of the other counties. That is about 4,560 tons of water on each area. Now that 4,560 tons of water has to supply the springs, supply the plants, supply every demand for water except right down on the sea coast where it seeps into the ground. The water that flows down the surface and washes away the soil should be reduced to a minimum. That can be done by surface tillage; have the land plowed and harrowed and the soil kept loose. I had the boys in my class prepare two cans, in one of which they packed the soil down hard, and

in the other they just harrowed it and left loose, and we found that the loose soil will absorb eight times as much water as the other. Now, if you keep your soil in a hard condition, you will lose one-half your water. If you have land that slopes, it will pay you to plow around the hill and leave a ridge of sod occasionally to prevent the water from running out. I am talking about soils that wash away, thus reducing the value of the farm. I know of one case where a field on the east side of the hill had been used as a cherry orchard for years, but after reading the agricultural papers the farmer decided it might be well to plow it, and he did so for about four years. One day he noticed a peculiar mark on his trees. He looked at it, and found it was the old soil mark, showing where the soil had washed away. So he went back to the sod. Watch the washing on your hillsides in order to prevent it.

Now, more of the water will pass down through the ground into the reservoir there. You may have to go down 12 feet, or you may have to go down two hundred feet before you find what you want, but when you get down to it, that is the ground water level. It is the water that comes down through the ground and collects in the reservoir that is of value to the plant, because some of it comes back to the surface by what is known as capillary attraction. This simply means that it passes up through the soil as the oil passes up through the wick of the lamp. You don't speak to the farmers about the capillary tubes. That is not the right term. They are simply very fine grains of soil, which will take up the water as they come in contact with it. That is capillary film. It is simply a little layer of water on the outside of this soil grain, which by surface tension tends to lift more water up until it reaches the particular point where the soil can hold it by proper action. By this means the water is raised to the surface, and there made to evaporate, and used by the plants.

Now, the water that comes into this water reservoir may be lost in three ways; first, by slow drainage; second, through the plant, and third, through the air. Now, that which goes through the plant is beneficial to it, but the last is actually harmful. In this chart I will give you the amount of water that is removed by the soil in growing these crops that are shown. This work was done in Iowa, about 1895. It very clearly demonstrated the amount of water in each foot of soil, to a depth of 6 feet, through a period of thirty weeks. The crops were growing all during that period. During that period about 25.8 inches of rain fell. There was very little surface run-off. The rains were slow and gentle rains, and, according to that bulletin, practically all of them ran down into the soil. Now, we found that one ton of clover hay took out 1,560 tons of water, or the equivalent of 13 inches of rain-fall. (You remember that I said in Pennsylvania we get about 4,500 tons of rain-fall.) Corn fodder took out, for one ton, 1.7 inches of water, equivalent to 15 inches of rain-fall. One ton of oats, 1,200 tons of water, or the equivalent to 11 inches of rain-fall. Two hundred bushels of potatoes required about 280 tons of water, or about 5.6 inches of rain-fall, and one acre of pasture land took out 3,383 tons of water, or about 28 inches of rain-fall. Now, that was ordinary blue grass pasture, which never got very thick, and never

grew very thin. Up there we have only about 32 inches of rainfall, so that it would take about all we can get to keep up our pastures.

Now, the rise by capillary attraction is shown on this chart. It does not show off very well, but it shows the height to which water rises in inches. I show you this in order to show you that different kinds of soil have different degrees of capillary power. The sand receives it very rapidly, and draws it from the reservoir very fast, the first few hours; during the first half hour it raised up 3 inches, while during a period of twenty-four hours, it only raised up all told 6 inches. Sand will raise the water very rapidly during the time it can raise it, but the grains are so large that we have no small films and, consequently, no power to draw it very high.

Sandy loam raised it about 25 inches; loam still higher, and silt loam higher still—up to 28 inches, but it was slow in getting it. Silt loam can raise it very high. The rise would be aided by the rain coming down and covering these soil grains with moisture, but in this case the work was done very slowly by capillary attraction only.

MR. SCHWARZ: Have you any idea what clay will do?

PROF. SHAW: I do not use clay, because I could not get any good clay. It will raise it higher than these. In silt loam the water has to squeeze through very little openings. Silt is about the size of ordinary flour. Limestone soil is the best thing for the capillary raising of water.

Now, the water that comes from the surface, and does not enter into our plants and become a part of their life, disappears through evaporation, and is lost to our farms. In the case of water which is passing through the soil, what is not taken up by the plant is evaporated, and this evaporation, in our garden soils, cool the soil. It takes 600 calories of heat to evaporate one unit of water. The amount of heat necessary to warm one pound of water is 600 calories. If you put your corn or oats in the ground in the spring, and want them to sprout quickly, you want to prevent the moisture from evaporating. The evaporation from the soil would easily retard the sprouting two or three days. If you could drain that soil, and mulch it, you can get very much quicker results.

Now, the prevention of evaporation is done by mulching. You allow the first three or four inches of soil that you turn up to dry up, and that dry soil will not let the moisture rise rapidly. If you cultivate once a week or ten days, or in the very best soils, once in two weeks you can keep that surface soil dry enough to prevent evaporation. You want to keep on that surface about three inches of dry soil; the water cannot go through that very readily, and you will thus prevent evaporation.

Now, if you are growing vegetable garden crops—strawberries, &c., in order to conserve the moisture you may want to make a mulch of straw and leaves. In our experiments we found that the least loss came from the leaf mulch; the next from cultivating the soil, and the greatest loss from the bare soil. We lost 83 per cent. with no mulch; 56 per cent. by cultivation, and only 32 per cent. by the use of straw and leaves.

Now, the only thing that you can do to save the water is to cultivate. Cultivation is a very small matter. You have to cultivate to keep the soil in proper condition to grow your crops, but cultivate frequently, and advise your neighbors to cultivate often, and you will have no trouble in growing that extra bushel of corn, which will net the farmers of this State the \$70,000 that is lost annually through lack of proper cultivation of the soil.

COMMERCIAL ORCHARDING.

By DR. J. H. FUNK, *Boyertown, Pa.*

Mr. Chairman, Bréthren of the Nobility, Princes of the Plow, Kings of the Orchard, Queens of the Home: I am proud indeed to stand before so many of my friends in this, our Annual Round-up Meeting.

I feel honored in being called upon to address the Original Aristocrats of the world, for the Crest of Eden is upon your escutcheon, and your vocation is one of the dignities conferred upon man before the fall. In it lies the foundation of all activities and civilization.

Agriculture is the mother of all industries, and they thrive only because she thrives, and you her subjects turn the wheels of the world, build the world's muscles, and furnish the world's tables. And other industries prosper only as agriculture prospers. So gentlemen, you are above kings, for they must look to you for their bread.

Your responsibility is therefore great, your calling sacred. To be in close proximity with nature, in God's great laboratory, watching the mysterious forces, starting with the tiny seed, causing it to germinate, sending its minute rootlets down into mother earth seeking nourishment, and its crown seeking the light of day, the dews of heaven and the sweet kisses of the morning sun, welcoming its genial warmth to aid in its development.

If the saying be true, that the mental and moral status, the nobility and purity of character depends upon what a man eats, then indeed the Nation's manhood depends upon what you grow, and as fruits took precedence in the Garden of Eden, and have a marked influence on the mental capacity of man, then truly the horticulturist merits the highest honors to be conferred.

It is only within recent years that Commercial Orcharding has attained any prominence among the business enterprises of the world.

In the earlier history of our country, when every variety of fruit grew spontaneous, and bore abundantly, with no marauding animals or insects or fungus diseases present to interfere with their thrift or productiveness, or to mar their beauty, when our virgin soils were full of all the elements necessary to their best development, with humus in abundance, a veritable reservoir of moisture and fertility, in the most available form, and inexhaustible supply. Yet with all these advantages fruit raising was largely incidental to general farming. The farmer being satisfied if he had enough fruit for the use of his family, a few bushels to sell, enough to supply the vinegar barrel, and for drinking cider.

But a change has taken place, and instead of fruit being a luxury for the indulgence of the rich, it has become a necessity, and is called for and is placed upon the tables of the mechanic, clerk and every class and condition of people, no matter how humble, and is considered a cheap and healthy article of food.

What has been the effect of the change? While the demand has been increasing, the supply has been diminishing to such an alarming extent that unless a radical increase in production takes place in a short time the United States will be importers instead of exporters.

The United States statistics show that in the year 1895, sixty million, five hundred and forty thousand (60,540,000) barrels of apples were produced in the United States, and from then there has been a gradual but rapid decrease until in the year 1907 there were but 25,000,000 barrels produced, a decrease of over 50 per cent. Does it not behoove us as a nation to investigate the cause?

It is certainly not entirely owing to weather conditions, though the cutting away of the forests have changed climatic conditions to a marked degree. Lack of fertility from over-cropping and under-feeding, with poor cultural methods, have doubtless contributed their share to the cause of failure.

But the greater cause is beyond doubt the advent of the San José scale, and in the last few years it has increased to such an alarming extent that no matter where you travel the same conditions exist. The farmers' orchards are either dead or dying, and the average farmer is doing nothing to stay its progress, or replacing with new orchards.

This last winter, while at institute work in the central counties of the State, in eleven counties I did not see one dozen new orchards planted, and very few thrifty orchards of any age, and the majority of the farm orchards in the last stages of decay. This is indeed a sad condition, and it is only by the establishing of commercial orchards as a business that our fruit supply can be kept up to meet the demands of our intelligent and prosperous nation.

COMMERCIAL ORCHARDING AS A BUSINESS.

Growing apples and other fruits is like any other line of business. Some will succeed and live in fine houses, others will live to scratch a poor man's back all their lives.

But there is no vocation in which a man who has philosophy in his composition can get as much happiness, contentment and profit as in fruit raising.

He who plants a tree, plants Hope, Love and Good Will. He works not for himself alone, nor for the time in which he lives, but for the good of his fellow-men and the future.

It is an attractive business. Failure is impossible, if he possesses that defiant trinity, Skill, Enterprise and Progress. This combination is the sheet anchor that has made the building up of every great business a marked success.

The successful orchardists are specialists. Some in apples, some in pears and peaches, while others make a specialty of small fruits.

They succeed because their work is concentrated, intensive. Everything is done for the tree or vine that can be done that it pays to do.

The main object of the special grower is to grow the largest quantity of the highest quality of fruit that can be produced on an acre.

To accomplish this requires an immense expenditure of study along every line.

What are the requirements of a successful fruit raiser? He must be a good farmer, and understand working the soil to get it in the finest tilth, that it may retain moisture, so necessary to success.

He should be enough of a chemist to understand the mixing of fertilizers, to know what chemical changes takes place, that the proper food elements are set free at the time they will do the most good to the growing crops.

He must be an entomologist, to identify the insect enemies that injure his crops. Their life history should be understood, that he may know how and when to combat them.

He should familiarize himself with the various fungus diseases, and how to keep his trees and fruit immune and in a healthy growing condition.

He must read, think, study and apply the knowledge obtained, in a manner that will be most affective.

He must be a good business man, to buy his supplies and market his crops to the best advantage.

Fruit growing is high-class farming on intensive principles, and is undertaken largely by bright, observing men who are more interested in their profession than the ordinary farmer. They are men who are above the ordinary in intelligence and energy.

As time passes we note more the need of man taking the initiative, and leaving less to nature.

In old times, and in opening new territory, extensive methods were doubtless more profitable.

In extensive farming Nature is depended upon to do the greater part, man comparatively little.

In intensive methods the opposite is attempted, and Nature is assisted and encouraged to do her best.

As time passes and land becomes scarcer, labor higher, better methods must be adopted.

There are many things to be considered in fruit raising. The field is so broad, and embodies so many features, any one of which would give material for a long article, we can at present include only the most important.

Whatever views I may express shall be limited to those obtained from personal observation, and I shall ask you to make all necessary allowance for variation in soil, climatic conditions, &c., which may vary somewhat from your local conditions.

The most important factors are: Soil, latitude, altitude, location.

and needs abundance of both, they fail, the fruit ceases to grow and drops.

Clay is too compact, being almost impenetrable to water and air, making a heavy cold soil that is uncongenial to the best development of fruit of good color and quality.

For the apple, other things being equal, a good deep clay loam is the best. I say this for if the surface soil is thin, the rock coming near the surface, it will not be profitable.

It should be fertile, containing an abundance of mineral and organic matter, without which no crop can grow.

ALTITUDE.

This is of more importance than most people think, and it should be given due consideration. An orchard must be well exposed to air and sunshine, as they are the great germ destroyers. An orchard fully exposed is much less subject to fungus diseases.

Avoid narrow valleys and deep depressions, or small streams, as they are subject to late frosts in the spring, and early ones in the fall. The former is very disastrous to fruit buds which have become expanded by a few warm days in these apparent favored nooks, the cooling influence of radiation has lowered the temperature, the air becomes chilled, becomes heavier and flows down into the depressed situations. This when near the freezing point becomes dangerous to fruit buds and bloom. The ideal site is somewhat elevated above the adjoining land, thus giving both water and air drainage. The latter is the most important, as soil drainage can be given artificially.

Flat low lands are more subject to frost than high lands.

A very slight elevation is often sufficient if bordering on an open valley to give opportunity for the cold air to pass away freely.

The Paragon Fruit Farm lies on a hillside with a rise of over 100 feet. The lower rows are nearly level with the creek passing within 200 feet. But to avoid late frosts, I planted late blooming varieties along the bottom. The Rome Beauty invariably open their's late enough to escape.

Elevation alone is not sufficient, it depends upon having a free outlet for the cold air.

EXPOSURE.

This is an interesting topic of inquiry. Some planters choose a southern or southeastern exposure, thinking the fullest exposure to the morning sun essential.

Others choose a northern, thinking this retards vegetation, holding the buds from expanding so early, thus avoiding late frosts and moderating the heat in summer.

The Passenger Express is the most rapid train in every direction.

in response to the call of nature when the tops are acted upon by the warm rays of the sun, excitation takes place in the buds, they draw upon the reserve forces stored up in their cells from the previous season, growth continues until the frost is thawed out and the roots are enabled to send up a fresh supply of raw material to supply the demands of the tree.

Strawberries may be held in check by being covered and the ground kept frozen, because here the entire plant, top as well as root, is in cold storage.

LOCATION.

This is of great importance in a commercial orchard. In a family orchard, convenience takes precedence. But when it comes to investing large sums of money and time in building up of a permanent business, it behooves us to look to the future.

Several things are essential to success. The principal ones are: First, shipping facilities; the nearer the orchard is to the railroad station, other things being equal, the better the prospects, for if it is located several miles from the station, and the fruit must be conveyed by wagons over a rough country road, the loss of time, expense, and injury to the fruit go far toward making it an unprofitable industry.

Help must also be looked after, for should the grower be unable to get sufficient help at the time fruit is mature, to gather and store it great loss may be the result through storms, freezing, &c.

It is more economical to purchase suitable land close to these facilities at a high price than to take an unsuitable piece of land as a gift. The former with proper attention will be very profitable, while the latter will almost inevitably be a failure.

PREPARATION OF SOIL.

The soil should be broken up deeply (preferably in the fall), 12 or 15 inches, if possible, leaving it without harrowing, to be more thoroughly acted upon by freezing. Then in the spring put it in the finest condition possible. Now is the time you have the opportunity, before the trees are planted. Should there be any low places where drainage is not perfect, this must be looked after, as no tree or plant can thrive with a wet, soggy soil. This can often be improved by plowing in the way favoring drainage. If not, then tiling should be laid. It will prove a good investment, as it will not only rid the soil of surplus water, but also admit air more freely.

FERTILIZING.

If the land is not fairly fertile, manure of some kind must be applied.

If humus is lacking, then stable manure, fifteen or twenty tons per acre, should be spread evenly over the ground before plowing. Should the soil lack the mineral elements, phosphoric acid or potash, these can be applied in the cheapest form, acidulated rock, and muriate, or sulphate of potash. These are the dependable fertilizers for fruit development.

VARIETIES.

The careful selection of varieties is an important factor in profitable orcharding. They must be adapted to the locality. The trees must be vigorous and productive, bearing good crops annually.

The fruit must be attractive in appearance, of good form, and bright red in color. It must be of high quality.

The ideal apple must possess the following characteristics: Tree a good grower, stem straight, open head, foliage not subject to fungus diseases, an early bearer, an annual bearer of large crops of fruit of good size, highly polished red apples, adhering well to the tree until fully matured, a good keeper, flesh yellow, crisp, juicy, core small, flavor of the best.

An orchard made up of trees possessing these qualities will be a veritable bonanza to its owner. Are there many such orchards? No, it is with orcharding, as it is with dairying, the profits are made by the few.

Personal liking or prejudices too often govern the planter.

Nurserymen's catalogs, filled with introducers' descriptions, is another pitfall for the unwary.

Too many varieties is another serious fault.

The horticulturist who loves his business is a progressive fellow and plants too many trees as an experiment.

What shall we plant? For a family orchard plant Yellow Transparent, Red Astrachan, William's Red, Jefferies, Summer Rambo, Wealthy, Grime's Golden, Nottingham, Hubbardston, Heiges, Smokehouse, Stayman Winesap, Salome, Rome Beauty, Highfill, Paragon, York Imperial and Nero.

These varieties are sufficient for the family orchard. The commercial orchard should have but few varieties, and might be made up of Yellow Transparent and William's Red for early, where there is a good demand for early apples. Summer Rambo, for a second early, is productive and a good all around apple. To this may be added Grime's Golden, and Nottingham for late fall, but the largest planting should be winter apples, and I believe that an orchard planted one-third Hubbardston, and two-thirds Stayman Winesap, will make the grower more money than any other varieties that can be planted, as they are both extremely productive of large, fine-appearing apples of high quality, always bringing the highest prices in the market.

TRANSPLANTING.

For the apple it makes but little difference whether planted in the fall or spring. If there is a choice it would be in the fall. First, you can get better stock before it is depleted by heavy sales.

Second, the planter generally has more time in the fall, and gives more care to the planting.

Third, the fall-set tree has time for the roots to callus and sends out new roots before the buds start in the spring, and is thus better prepared for the drain upon it through evaporation from the foliage. Fall planted trees generally make a better growth the first season. If planted in the spring, it should be as early as the ground is in condition.

LAYING OUT THE PLOT.

Leave sufficient space around the tract for convenient turning while cultivating, at least thirty feet. It is not lost ground. Then, with an assistant and a tape line, beginning at a corner, measure and stick stakes every thirty-five feet all around the plot. When running the intermediate lines place sight poles at the stakes, and the lines are easily made straight.

If the land is in good tillable condition this can be done better with a good team and a large plow, running back and forth three or four times, which opens a large, broad and deep furrow and puts the ground in better condition than can be done by digging holes, and at one-fourth the cost.

In planting, the tree should be set about one inch deeper than it stood in the nursery, and the soil should be firmly packed around the roots. Many trees are injured and growth stunted by too deep planting and often never recovers.

AGE OF TREE.

If a peach, never beyond one year old from the bud. If an apple tree, a one year whip without limbs 4 to 6 feet is preferable for several reasons. First, a tree of this kind is a tree of strong individuality, with a good root system. It is full of vitality, the very cream of the nursery.

Second, it can be dug with less injury to the roots, less shock is given to the tree, it is less liable to suffer by transplanting, and starts off more readily, and makes a much stronger growth than an older tree that has a larger top to support and less roots to do it with. A tree of this kind will come into profitable bearing sooner than the older tree.

As every planter has his ideals as to shape and form, a young tree without limbs can be trained as desired. If the planter wants a high tree, he can train it thus, or he can train to a low head. He can start with 3, 4 or 5 limbs, or as many as he desires upon which to build the head. He can give it any shape or form.

SHAPE OF TREE.

Low heads are to be preferred. They are not so liable to be injured by heavy storms, as the leverage is less. The trunk is better shaded, and the ground kept from drying out so much in summer. The tree is more convenient to manage, it can be pruned and sprayed from the ground, the greater part of the thinning of the green fruit, and the gathering of the matured fruit can be done from the ground, and the balance from a low step-ladder, greatly

PRUNING.

Time will not permit going into details on pruning, as only the most important factors will be treated here.

All mutilated roots should be cut away. All other roots should be cut back, from below outward to about eight inches in length.

The top should (if a one-year-old tree) be cut back to about 24 inches from the ground, cutting off above a sound bud. When the dormant buds have made a growth of one-third to one-half inch, rub off all but about five buds. These are to form the frame-work for the top. Never leave two buds opposite, as they are apt to form a fork which is liable to split when laden with fruit, or from storms and ice incrustations. These buds will grow rapidly, and must be watched, the upper bud becomes the leader, and will grow the fastest, and may need pinching back to check growth and throw more growth into the laterals, thus equalizing the top.

If the tree is two or three years old, with the top already formed, and often very ill-shaped indeed, the limbs should be cut back fully three-fourths of last season's growth, cutting above an outside bud. If it has too many limbs, cut some away, using judgment to get a symmetrical top. The second season the last year's growth should be heavily pruned, cutting to an outside bud to spread the tree. This should not be omitted, as the greater the expanse according to height, the better for fruiting. Prune away all useless limbs. If this is attended to while the tree is young, large limbs will not have to be cut away later, which should be avoided if possible.

WHEN TO PRUNE.

Whenever the tree needs it, never prune without a purpose. If a limb is in the road take it away at once before it drains heavily on the tree, and give the laterals on the other limbs a chance to spread and develop fruit spurs.

A young orchard needs healthy, vigorous wood growth. For this purpose spring pruning is preferable.

If the tree has attained bearing age, but lingers in doubt, adopt other methods. Prune in June to develop fruit buds.

Leaf buds and flower buds are not structurally distinct, every bud on a tree is formed as a leaf bud, and every bud on a tree has the power under proper conditions of becoming a flower bud.

Leaf and flower buds are interchangeable.

By pruning away a branch immediately above a flower bud, it may change to a leaf bud.

By ringing a limb below a leaf bud, it may be converted into a flower bud.

Factors that tend to the formation of flower buds are any restriction of the prepared food in the branches, such as ringing, bending the limbs. Dry weather is also conducive of flower buds.

Since during dry periods, evaporation through the leaves is rapid, the sap becomes concentrated and rich in prepared food.

When water supply is abundant, the tendency is toward wood growth and leaf buds. Rapid growing trees seldom bear much fruit.

Anything that retards growth increases the fruit yield. Fruit buds do not generally develop until after wood growth ceases, then continues until fall.

THINNING.

By thinning we mean the removal of a portion of the young fruit, and thus prevent overbearing.

Many factors may arise to prevent annual bearing. A light crop generally follows an excessive one. There are no reserve buds. Only the buds formed the previous year are developed, and the draft upon the tree necessary to develop so much fruit prevents the formation of flower buds for the next season.

Climatic conditions control more or less bud formation, yet the intelligent horticulturist may so change conditions as to make Nature's laws subservient to his will.

Thinning is one of the great aids. By removing a large portion of the young fruit, the excessive drain upon the vitality of the tree is prevented. The fruit attains much greater size and improves the quality, and allows the tree to grow good, strong buds for the crop the following season. It is not the edible portion, but the seed that exhausts the tree, so by thinning in connection with other cultural methods an annual crop of fruit of one quality may be expected and the grower will realize much better prices.

CULTURE.

This is a mooted question with fruit growers, whether to adopt clean culture, mulch or sod. All have their advocates, and all their successes. All these methods, if other details are properly attended to, will succeed.

It is a matter that must be controlled by the environments, such as location. Steep hillsides could not be kept under clean cultivation, as there would be too much loss by washing.

But where land can be cultivated, I believe a young orchard will make better growth by clean culture. In later years, when in bearing, it makes less difference if the tree is well fed.

Mulch is Nature's method of enriching the soil, and this may be used to good effect in fruit raising as well as growing forest trees. I hope I will not be misunderstood. I do not mean to say that fruit raising and forestry requires the same treatment.

Nature aims at reproduction, seed development, at the expense of the edible portion.

Man works for the edible part at the expense of the seed. The nearer he can eliminate the seed from the fruit the better it suits his purpose, consequently he must work along different lines.

Clean culture will produce larger fruit, but it will lack color and quality. Sod will produce crops of fruit somewhat less in size, but of higher color, better quality, and will keep longer. But space will not permit the continuance of this topic. Suffice to say, adopt the method that best serves the conditions, but never omit

by every motion of the picker. Such fruit is not only unsightly, but its keeping qualities are impaired. When picked it should not be put in piles in the orchard, as the exposure to heat and cold, air and moisture hastens the ripening process leading toward decay. But it should be hauled on spring wagons to a cool packing house, to be graded and packed in clean new barrels or boxes and shipped, or stored in an even temperature. If to be kept long it should be placed in cold storage, where the temperature can be maintained at between 30 and 32 degrees F.

PACKING.

If the fruit is fancy, of uniform sizes, well colored, and good quality, such as is wanted for fancy dessert fruit, then the standard bushel box is the best package. Each fruit should be wrapped in neat, suitable paper and packed, that each box, according to the size of the fruit, will have an equal number of apples, the same as oranges.

All others should be packed in barrels; but those should be graded.

Avoid packing all small, wormy, knotty, ill-shaped fruit.

Assort into four grades, fancy, No. 1, No. 2 and culls. In facing, put first in the bottom of the barrel a corrugated pastboard header. On this place the so-called headers (which should be of medium size, uniform and nicely colored). Place the stem end down, fitting them tightly until the bottom is covered, then place a second layer on top of these. Then pour gently on top of these a basket of fillers and give the barrel a gentle shake. Continue until the barrel is full. Even off the top, having it filled about one inch above the barrel. Place another corrugated paper on the fruit, place the head on this and with a screw, or a foot press bring it gently into place, tighten the hoops, put in cleats to hold the head firmly in place. Turn the barrel, cleat this end, and label according to the quality the package contains.

Never attempt to deceive. It is a poor business policy. Never face with choice fruit and put inferior fruit in the middle of the package and label fancy. Always label true to contents. The only one deceived, or fooled eventually will be the owner, as his sins will surely find him out. Sell all packages under a full guarantee. Have a trade mark and make the standard so high that it alone will sell the fruit.

MARKETING.

If you have followed the other requirements, all you have to do will be to hold until the prices suit you. You need not seek for customers. The customers will seek you. One satisfied customer makes many. You can control the market regardless of gluts of inferior goods. I never saw a glut in fancy goods.

INSECTS AND FUNGOUS DISEASES.

They are here, and here to stay, and unless the fruit raiser is wide-awake to his best interests they will run him out of the business. If you doubt this look at your own orchards, and the fruit you raise. Then look at your neighbors. Many of you have traveled nearly across the State to get here, and have doubtless taken

notice of the condition of the orchards. If not, then on your home-ward trip keep tab on the good thrifty orchards you see, also note those off color, the dead and dying. Note how many young orchards you see planted and the condition they are in. When you get home look over your notes. Then answer for yourself as to the future of the apple industry of Pennsylvania, and most other states are in the same condition. Can this state of affairs be remedied? Yes, but you must do it yourself. Do not depend upon your neighbor. Do not depend upon the State, the Government, or any other source of help. Get right at it. Keep at it, open a warfare that will be irresistible. Vanquish the foe. If it is the San José scale spray him. Make it so everlasting uncomfortable that it will yield up the ghost.

If the Codling moth makes your fruit unsalable, resort to the same measure.

As soon as the bloom drops, give them a dose. Apply it with energy and power. If one dose is not enough, give them two, and they will call it quits.

If other insects trouble you, treat them accordingly. If they are masticating insects, give them a dose of the arsenites.

If they are sucking insects, give them a contract remedy. Cover their hides, throw it in their eyes, and they will let go their hold.

If it be the Scab, Bitter Rot, or any other fungous disease, act on the defensive, or rather the preventive, as you cannot cure. You can prevent, and hold it in check, and thus save what is not affected.

Use the copper salts, or the dilute sulphur sprays.

As to the manufacture of these various sprays, they have been so fully treated in the many bulletins issued by the various colleges, and by eminent writers for the various agricultural and horticultural papers, that it would be a waste of time to enter into details. I will merely say here that I believe that the lime and sulphur spray will be as much and as successfully used as a summer spray as it is now used as a winter spray.

WILL IT PAY?

This is, of course, the natural inquiry, and to the careless, indifferent farmer it will not pay. The greater bulk of farmers are willing to let go before they get a firm hold. Don't get discouraged; get a firm grip and hold on.

The man who has a good orchard ten years from now has a bonanza, a better paying dividend investment than Standard Oil stock, and one that is untainted.

There is no business opportunity today that offers our young men and young women (and even you older people) such good inducements as fruit raising. It is pleasant. It is healthful. It pays big, and it will pay better in the very near future.

I could point out many large commercial orchards scattered all over this country that are bringing in their owners princely incomes. But I will not weary you with statistics.

The old saying is, all things come to those who wait. But my advice is: Don't wait, but go after it. Keep after it until you catch up. Then get ahead and keep in the front rank, and all the good things intended for the use of man will be yours.

MISCIBLE OILS.

By PROF. CHARLES L. PENNY, *State College, Pa.*

Petroleum oils have been used as insecticides now for a number of years. Apparently their use is growing, rather than lessening, and this in spite of much distrust of them, high cost, or unusual difficulties of preparation.

Why these oils are poisons is hard to explain, though as much might be said about many other poisons. Possibly if this phase of insecticides were better understood, better agencies and methods would be possible. But at the very start, any one seeking new means of attack on an enemy so numerous, prolific, and widely scattered as are many insect pests, is embarrassed by the question of cost. To suppose that five per cent. of the material applied to leafless trees ever hits them at all, to say nothing to remaining long enough to kill insects, would seem to be an extravagant estimate, far above, rather than below the truth. Such a use of materials must be expected as probably wasting 90 per cent. or 95 per cent. Hence it is evident that of the large number of insecticides very few would be cheap enough, however excellent they might be in themselves, to be used profitably in so extensive an operation as orchard spraying.

Most true, poisons seem to be poisonous to all grades of life, though, fortunately, in different degrees of intensity, or with different degrees of susceptibility. The exception is found in poisons that act on the higher nervous system.

This fact demands a rather delicate, sometimes as impossible, gradation of the strength of the poison to the peculiar circumstances of the case. As the insects to be destroyed are closely associated with vegetation, it becomes an essential feature of the problem to kill one and not seriously harm the other. The innocuous character of spray material is even more important, if possible, than the poisonous character; it is even more important to spare than to kill. The sensitiveness of both plant and insect is different at different stages of their lives, or at different seasons of the year; hence we find seasons at which the problem is easier than at others, and some seasons at which it may be well-nigh impossible.

But generally the lines are inconveniently close between the sensitiveness of the plant and that of the insect. Were it otherwise, the problem would be much cheaper and easier. In fact, we must suppose that it costs more money to save the plant than it does to kill the insects; that is, the protection of the plant entails more than double the care and expense necessary to kill the insect alone.

Petroleum oils used as insecticides are amply strong—strong enough to stand dilution from ten to twenty or twenty-five fold. Furthermore, vegetation would suffer severely, usually fatally, from most undiluted oils. The only exception is found in winter, and then not certainly. This fact, from an economical point of view,

is fortunate, since the same money spent for oils may be made to bring greater returns through proper dilution. In actual practice, the dilution of oil brings peculiar difficulties, and these difficulties are the sole cause for the existence of "Miscible Oils."

Liquid sprays may be considered in two classes: First, true solutions, such as ammoniacal copper, lime-sulphur washes (in their essential portion), bluestone, &c. Second, suspension of the active agent in water, such as Bordeaux, various arsenicals, &c.

The former class admit of instant and convenient dilution—a permanent dilution; the latter class may be diluted about as readily though the suspension is never permanent, no matter what the strength may be, but demands rather constant agitation.

In this respect petroleum oils are in a class by themselves. They are not soluble in water, and they permit very brief and imperfect suspension when simply mixed with water as other materials are. Proverbially, oil and water will not mix. The whole end in view in compounding miscible oils it to make petroleum oils like other spray materials in this respect, viz: to make them mix with water in any proportion.

The mixing of oil and water has been attempted in two different ways: First, mechanically, and second, by the use of certain chemicals.

The mechanical method has generally consisted in pumping the two fluids through a common nozzle under a high pressure so that the two fine sprays should commingle for at least the brief instant required to pass from the nozzle to the tree. The proportion was regulated by the variable capacity of two pump barrels with adjustable stroke—or in some cases, by the size of the nozzle. An ingenious nozzle was devised for the purpose nearly ten years ago by Prof. E. D. Sanderson, now director of the New Hampshire Experiment Station, on the principle of causing oblique and fine streams of oil to infringe against a central stream of water, the mixture occurring at the point when the two liquids escape a common air-pressure acting on both oil and water. The device is certainly ingenious, at least.

From the fact that mechanical mixers of some sort have been long known, pretty widely used, much advertised, are by far the cheapest method, and notwithstanding, seem to be used now but little, it might be inferred that such devices have not been found wholly satisfactory in practice. Imperfect mixture, too coarse a mixture, giving large, undiluted drops of oil, inconstancy and uncertainty of proportion, seem to be defects never satisfactorily obviated. Were it otherwise, it would be hard to see any reason at all for the various miscible oils now used, either costly to buy,

is evident from the most familiar emulsion, milk. It is doubtful if mere mechanical force can be brought to sub-divide an oil into globules such that they will not run together. Some re-agent seems always to be necessary. All the emulsions of petroleum oils described seem to depend upon some kind of soap for their formation.

It has been known for a long time that kerosene emulsions can be made by the use of soap. The difference between the older method and those used in making miscible oils lies chiefly in the amount of water present when the kerosene and soap are first brought together. Common soap dissolves in water; it also dissolves wholly, or in part, in kerosene, provided there be not too much water present. Now, so far as we can understand the cause of emulsions such as are here discussed, it seems to be that the soap first dissolved in kerosene and then thrown in the water, dissolves in the water and in doing so divides the kerosene into exceedingly minute globules, which for some reason remain apart for a time, whether minutes, hours or months. Any thorough explanation of emulsions we are unable to give, for there are many mysteries and seeming contradictions to be found, but the general principle seems to be that a soap separately soluble in both water and kerosene, will, if first dissolved in kerosene, usually cause an emulsion when the kerosene is mixed with water. That such is not always the case is simply an instance of the vagaries to be found in this subject.

While soap is the indispensable constituent on which the formation of these emulsions depends and which will of itself cause excellent ones, there are other substances that greatly assist in the process. Such are carbolic acid, ammonia, and strangely enough, water. These alone will not cause emulsions, but in conjunction with soap, they sometimes improve them.

That we are unable as yet to prescribe precise laws governing the making of emulsions need hardly cause surprise if we consider how thoroughly the great natural emulsion, milk, has been studied, and how little it is understood.

Viewed under the microscope with a power of about 200 diameters, various emulsions show marked differences. In most cases there appear globules sometimes fairly uniform, sometimes varying greatly, in size. These range from a few hundredths of an inch down to less than one ten-thousandth of an inch, or to the point where they become invisible.

The soap-kerosene emulsion made in the old way by boiling with soap and water shows the field completely filled with densely crowded, rather uniform globules, whereas the emulsions from miscible oils, containing as much kerosene, show but a paltry fraction of the number of globules. If we assume that all of the kerosene in the former case is in the form of visible globules, then in the latter case, certainly not one-tenth, more probably not one hundredth, of the kerosene is visible under the power used. In other words, in the latter case it would seem as if only a very few straggling globules of oil are large enough to be visible at all. In all probability, nine-tenths, or even ninety-nine hundredths, of the kerosene is so finely divided as to be wholly invisible when magnified two hundred diameters.

As just intimated, the old-time domestic kerosene emulsion was made by mixing soap suds and kerosene, sometimes with the aid of heat, sometimes with rigorous mechanical agitation. The emulsion was not very permanent, nor was it concentrated; it was necessary to subject to the treatment nearly all of the liquid to be used finally.

The miscible oils, at least those of published formulas, depend on soap likewise for their emulsifying properties. But in this case the soap contains little water, possibly none, and is commonly dissolved in the petroleum oil. The soap may be made specially for this purpose, or commercial soap may be used; in either case, carbolic acid greatly facilitates the solution. Once mixed, the proportion is good indefinitely, at least over a year, and at most requires no more than vigorous stirring to make it perfectly unsable. The soap mixture, which may be called the "emulsifier," is the only portion that requires heat, or manipulation of any sort. Now, the emulsifier is but a small part of the final spray material; in fact, from 1-150 to 1-200, according to dilution.

It will be clear, then, that a few gallons of the emulsifier will suffice to treat a large quantity of petroleum oil, the proportion varying with oils used, from 1-12 to 1-15; sometimes the ratio is wider.

The method of making the emulsifier and of mixing it is rather too technical for a detailed description here; it may be found set forth fully in a number of experimental station bulletins. We can consider here still further only some general properties of miscible oils, directions for using the oils, and their value.

Crude petroleum is a mixture of very various bodies, some exceedingly volatile, more so than gasoline, others non-volatile at normal temperature, with many grades between. In practice, three kinds are used for spraying: crude oil; the common refined coal oil, or "kerosene," and a heavy lubricating oil, commonly called "paraffine oil." The choice of these is extremely important.

Now, orchard tests with the light kerosene emulsions and with the heavier oil emulsions all seem to lead unmistakably to the conclusion that kerosene emulsions alone are not efficient insecticides for winter use unless in extraordinary concentration; that something more viscid than kerosene, with more body, and perhaps with better staying qualities, is needed to do the work. There seems to be good evidence that kerosene is efficient when used in sufficient concentration, but it probably evaporates too rapidly to permit to its fullest efficiency. Furthermore, it seems probable that the virtue of the heavier oils is due not only to their greater permanence, but also to their viscosity or gummy character.

The conclusion that kerosene in moderate amount is inadequate as a winter spray and that the heavier oils must be used during that dormant season, should not be understood as contradictory of some of the excellent results reported by some investigators with kerosene emulsions. These, however, usually contain a relatively high percentage of kerosene, in some cases as much as 25 per cent. or 30 per cent., whereas 10 per cent. of miscible oil is a very strong emulsion, and as the miscible oil is in part water, soap and carbolic acid, the oil portion is less than 7 per cent. and often only 5 per cent. of the winter spray material.

It seems most probable that the period of working of these oils must extend over many days; hence it is clear that a rapid loss from evaporation is a loss of efficiency, and thus becomes a most important consideration. Where action is practically instantaneous, as with a cyanide, volatility has no significance, but with oils it is wholly otherwise. This difference probably explains in a measure why so much more kerosene than crude oil is needed to accomplish the same result.

Kerosene is the easiest oil to emulsify, soap and carbolic acid being all that is required. The heavy oils are more difficult, and for some reason respond to treatment much better when a small amount of an additional oil is used, viz., rosin oil.

A perfect miscible oil ought to fulfill two conditions: First, it ought to remain under all conditions of temperature and rest, perfectly uniform throughout, without any separation into layers of different density and composition, and second, it ought to give an emulsion infallibly when mixed with water in any manner whatever, whether the water be added all at once, or in small quantities at a time. These two conditions are sometimes fulfilled at once, but not very often in the case of some of the formulas. It is relatively easy to secure either one, but frequently quite difficult economically to combine both in a single oil. That is, it is usually easy to prepare a miscible oil that will remain in a homogenous uniform solution, but it will not give an emulsion unless the water be added in a peculiar way, that is gradually. And, on the other hand, it may be easy to make a miscible oil that will give an instant emulsion, directly mixed with a large volume of water, but the miscible oil itself, before it is mixed with water, will frequently separate on standing into two or more layers of different density and composition.

As many, or most, emulsions depend on a soap for their existence, anything that decomposes the soap will cause free oil to separate. Most salts of metals other than those of the alkalis, soda and potash, free acids, lime, etc., will do this. Hence most insecticidal and fungicidal preparations are incompatible with these emulsions; Bordeaux mixture, lime and sulphur, copper sulphate, or "blue stone" solution, and lead arsenate all decompose the soap and cause free oil to separate. Copper acetate causes a separation of oil, but more slowly; it might possibly be used if sprayed quickly. An exception is Paris green; this simply mixed with an emulsion has no effect. If, however, it is dissolved in ammonia, or ammonia be in the emulsion, there will be a rather speedy separation of free oil. Ammoniacal copper carbonate decomposes the soap, but if there be much ammonia it does so only slowly; it might be possible, in some cases at least to spray a barrel of emulsion mixed with ammoniacal copper carbonate before the free oil would separate. In other cases the separation is more rapid, within a few minutes; it would seem to be impracticable therefore to use this fungicide. If "soluble oil" or "concentrated oil" contains ammonia it would be better that it should not come into contact with copper or brass, as the metal dissolved by the ammonia, however little, tends to decompose the soap emulsifiers. This does not apply to spray material ready to use, for the ammonia is so diluted and the time of contact so short as to have no effect.

The utmost care should be taken that all vessels used in storing or mixing "soluble oils" and their emulsions are clean. Most contents of barrels, except coal-oil, are likely to be hurtful; at least, it is safer to assume such to be the case. The greatest difficulty is found with tanks, pumps, and, in fact, all utensils contaminated with Bordeaux mixture of the lime-sulphur wash; it is not easy to clean such thoroughly enough to use with safety. Pumps should be well washed out with water, and only uncontaminated tanks and vessels, such as coal-oil barrels, should be used.

There has been much discussion concerning the value and efficiency of miscible oils, especially as compared with lime and sulphur. Each remedy has had its champions and its opponents, with an ever-increasing class who admit the virtue of both and who use both. It would seem that it is hardly open to question now whether petroleum preparations, used in sufficient quantity and well applied, are efficient insecticides. The verdict that they may be depended on to "kill anything they hit" has come unsolicited from so many independent, intelligent and unbiased observers, that it must be accepted as true. Isolated failures, which are possible with any remedy, count for nothing as against so much positive evidence.

A further question concerns the supposed cumulative effects of oils, especially heavy oils on trees tested for a number of years with them. This is a serious question, perhaps not yet decided. But some of our best known entomologists and horticulturists advocate oils and owners of long experience continue to hazard their orchards by using them. It seems clear that oil sprays, if they have not come to stay, will at least remain with us for some time.

Another question of detail is at what dilution should they be used? This is more difficult to answer finally for several reasons. In the first place, several distinct bodies enter into these oil sprays besides petroleum oils, as soap, carbolic acid and rosin oil. We do not know how much effectiveness to credit to each of these several agents. It is probable that some of them, at least, have an independent insecticidal value. In the second place, the petroleum oils themselves are effective in a very unusual degree, kerosene and paraffine oil differing perhaps as much as 2:1. In the third place some of these miscible oils permit the admixture of a considerable proportion of water—not only permit it, but sometimes require it as essential to a good emulsion; the amount of water is somewhat variable, and as the finished oil is measured with the water included, it is not quite definite just what amount of efficient material is used to make a barrel of spray liquid.

In general terms, however, the one in twenty proportion advocated at first for miscible oils seems to have been found too weak. It is doubtful if ardent advocates of the oils now recommend so

I believe within limits it is wise. I believe that there are certain facts that should be understood concerning emulsions, whether by makers, or merely by users, and that such facts are a profitable subject of instruction for institute workers. The highly organized diversion of labor found in cities, is not always practicable in farm work. The farmer has always been a man of many trades, and probably necessarily so. Scattered as farmers are, expert specialists are not available, as they commonly are manufacturers. Economic theorists would advocate that each man should do the one thing he can do best and satisfy his needs by exchange. But we all know that theorists are not always safe guides. Last year a co-operative body of men made about 80 barrels of miscible oils for their own use. We estimated the saving at about \$1,000. I should think that several men might prepare the amount of oil within two or three days.

A further reason is that miscible oils lend themselves readily to adulteration with water. They are the only substance I know of that appears stronger and richer in proportion as water is added. It is not certain just what is in an oil that is bought, though several well-known makers are unquestionably honest, and furnish reliable preparations. Uniformity of results is dependent on uniformity of remedies, and this is perhaps best secured by knowing absolutely all the ingredients used.

Some commercial oils are unquestionably efficient and reliable, but just as unquestionably, many samples of home-made miscible oils are fully as efficient and reliable.

THE MAN AND WOMAN CROP.

By H. W. COLLINGWOOD, New York City, N. Y.

A good friend of mine looked over my program and said "You have the post of honor—the only subject upon which one can preach a sermon." I am not so sure of that, for there are men in this list who are capable of preaching a sermon from any subject. There should be at least one sermon, and though I am poorly fitted, I will try it.

If a text were needed, I would take that great story from Luke, of the rich man whose lands brought forth abundantly. That man was evidently a good farmer. Had he lived in this age he would have been an Institute speaker. His farm would be fully drained, his barn stuffed with alfalfa, and yard with pure bred stock. Perhaps he, too, would be likened many successful men who have won success by their own strong efforts—a little boastful that he was well provided for. You remember what he said:—

"And I will say to my soul—soul, thou hast much goods laid up for many years; take thine ease, eat, drink and be merry.

But God said unto him, "Thou fool! this night thy soul shall be required of thee; then whose shall these things be which thou hast provided?"

I shall therefore take as my text:

WHOSE SHALL THESE THINGS BE?

What things? Measured by dollars, the farm output of Pennsylvania is enormous. You raise over \$70,000,000 worth of hay alone each year. Put up in money values, the figures are almost beyond belief. What is more, the materials which you and other workmen take out of the soil give the value which builds your cities and keeps humanity alive and at work. That is true, yet those of us who have gray in our hair know that twenty years hence all this material prosperity will be as a tale that is told, unless we are really mindful of that text—"whose shall these things be?"

Now, by the "man and woman crop," I mean the human life and what it stands for on our farms. There is no way in which we can touch the future permanently, except through the children. The child is a little package of love and hope which we offer to the future. We try to squeeze out the mistakes we have made and to pack in what we ought to have done and lay it on the altar of our country as the best gift we can bring. Do you realize that most of us who are here cannot expect to touch the future with the large affairs of life? If we touch it at all, it must be through the little, humble things that make up a common life. I fear that many of us in our efforts to teach and help what we call agriculture, often shoot too high in the air.

When I was a boy I lived in a little sea-coast town near Cape Cod. A wharf was built by driving piles deep into the mud. The men who built that wharf measured as well as they could the mighty power of wind and tide and floating ice. These were the things that broke down the wharf, and to stand against them they drove the piles down deep. But in spite of this planning and fancied security, the wharf went down. They measured the power of the great destructive forces which they understood and were able to hold them at bay. Yet while they were figuring on those mighty things, a tiny worm which they did not consider was boring through these piles and slowly destroyed them.

Now I have come to believe that in much the same manner we are in an agricultural education building securely against the mighty destructive forces and yet neglecting the deadly smaller ones. I believe that in trying to give the State a quick show for its money at the Institutes, we are trying to put the dollar, the corn crop and the hay crop above the man and woman crop. There can be

need our money half as much as it needs our manhood and our children. We need new methods of farming. I assume that the best way to arouse the spirit and ambition of the average man is to bring more honest money into his business. That is not all, however, for we need new ideals of farm life and living. In old days when a man child was born, the babe was welcomed, because here, they said, was another soldier to fight for the king. Many a mother grieved in her heart in those days because her boy was born to be offered up as a human sacrifice, not for liberty, not for country, but for the king. The ideal has changed now, and I think most mothers dream of their boys as lawyers or doctors, or professional men. I would have you men and women of the Farmers' Institute labor to have this ideal changed again. I would have the mother plan in her heart that from the cradle her boy shall be trained for a farmer.

WHOSE SHALL THESE THINGS BE?

Now let us, as plain country people, throw aside the artifices of life and get down to the real truth and aim of living. We toil on our way with more or less ambition. Suppose we say that we gain the great aim of our kind. Stripped of the non-essential things, what is it except wife and child and a piece of land? No one ever gets more than these. Most of the sadness and failure comes from the lack of one or more of them. You and I know that life, of necessity, teaches us the beginning of many things—the end of none. Any farmer who sees the seasons come and go, and who sees through the years how God writes a message for good or ill upon his fields cannot measure his work and his planning by corn or stock or money alone—though these may be the essentials of success. That man knows, for it must come to him every time he stops to think, that, after all, the best legacy he can leave is the hope that his farm may be carried on as he would have it done. Whose shall these things be? Not the money Pennsylvania leaves to the next generation—not the produce in your barns, but the experience, the insight into life, the trust in God, the hope and joy of labor and the ambition to make your farm more productive and useful than ever? You cannot give your children anything better than these things. You can not pass them along unless there is spirit in your work—unless the man and woman are first on your farm.

I wish sometimes that I could have the power to glorify the dull, hard lives of men and women who serve their country in humble places. That is where the so-called classical education has an advantage over our modern system of doing things. The strong man may sneer at poetry and history, yet they may help and solace in time of trouble. One dangerous tendency of modern education is that it is too material and is crowding the spirit and reverence for true character out of life. Give me the power to make men and women of humble life recognize their real heroes and I will change history for the best. I remember how just after the Spanish war, every speaker seemed to think he must mention the charge up San Juan Hill. I heard it at dairy meetings, at hog meetings, fruit growers associations, a convention of nurses, and at funerals. Right within sound of the voices which shouted such praise there were silent men and women who had for years carried burdens of home

life which would put the soldier to shame. We do too much chasing off into the next country for heroes to worship, when the living and the near at home demand our attention and our respect.

I know a woman who was left with seven children on a twenty-five acre farm, and with a mortgage. Her husband's last words were "go on as I have done!" I can safely say that most men left in such a way should have wilted and spoiled the family. The woman took up the burden alone, ran a dairy farm, kept her family together and made them all useful citizens except the eldest. He was lazy and careless and did not work. Finally that boy fell sick, and an instant operation was needed. The woman took her little savings from the bank and sent this boy to the hospital. Not content with that, she walked each day from her farm so that she might sit for an hour with her boy. When I asked her why she did that she said "I wanted my boy to feel that he never could get well if his mother had not been with him." She wanted that boy to feel that not only life itself, but all that life is worth, came from her. You need not wonder that the boy made good. Compare the work of such women who give life and spirit, with that of the soldier, whose business it is to kill. I presume that every one of you Institute workers find it necessary in your lectures to go to history at times for examples of bravery or strong endurance. Let me ask you to try an experiment next winter. Cut out all the soldiers, the Captains of Industry, or other so-called great men, and take your example entirely from humble lives who have tried to serve their country as this woman did. Try and make your hearers know and understand that such lives are to be emulated rather than so-called great ones. Such a winter would leave its mark upon the history of Pennsylvania. The man and woman crop would be the better for it.

I know another woman in this State who determined that her children should have the best foundation in education. It could only be obtained for cash. The husband lost his job and they moved to the country where the man drives a milk wagon. That woman was born in Europe where she was taught gardening by her father. In order that her children might be taught as she wanted them taught, she hired a piece of land, manured it, had it plowed and harrowed, and is growing vegetables as only the foreigners can. In this way she is earning enough to give her children what they need, and those children are to be trained so that they will be good farmers.

I could give you hundreds of instances where farmers and their wives have done and are doing just these things in order that their

something that was dear to them in order that the boy or girl might have a chance. I do not know anything in this world finer than the sublime faith in what we call education, which prompts humble men and women to practice self-denial in order that their children may go to school. And there is no sadder tragedy in life than when such men and women find that the influence of the school or college has made the child ashamed of father's honest toil. That is a tragedy because father feels that his love and his toil have turned to dust and ashes at the touch of modern education.

You see I would put the man and woman crop first of all. These people who deny and toil in order that the best of life may go to their children are worthier to be called heroes than those who do the so-called great things of life. It is from the man and woman crop that what we hope for in the future is to come. God ever calls the leaders—those who go on the cross and do the great things of the world, from humble walks of life—the farm, the shop, the sea—wherever men work with their hands, and for the large part in silence. It has been ever so since David was called from his sheep to lead a nation, or when the Great Master of mankind went from the carpenter's shop and took so many of his helpers from among fishermen and farmers. It will ever be so. Forever the farm must not only be a factory and storehouse for food and fibre but for human character and honest manhood as well. The so-called wealth of the farm—the grain, the fibre or the food, all serve their purpose and pass on into other forms, but the man and woman crop—the human flesh and blood—endures to carry out the great mystery of living and the great problems of life.

Let me tell you why I think it is that God oftenest finds the strong and enduring qualities which make leaders out of men and women, in humble places, and more especially on the farm. I think there is a good reason for it, and it has a bearing upon our work for farm education. A well ordered farm home contains of necessity the humble and enduring virtues. A man to succeed on a farm must be industrious, thrifty, sober, careful of his reputation, firm, observant and independent. Enlarge these qualities and analyze them, and you will find the very things which great men must possess. The child cannot possibly acquire these qualities in town so well as he can in the country upon a farm, under the constant eye of his parents.

The home ties, too, are stronger where home means all that is worth while to the family—of comfort, study, fund or business. On the farm father, mother, sister and brother are bound together as they cannot be in town or city. It is much the same with true patriotic feeling. I make the statement with confidence that no real reforms in this country have ever been started and carried through from town to city. These things, the desire for freedom and fairer place in the world are born amid the solitude, wrought out by silent workers in lonely places, by men who slowly think out right from wrong while they work, with their hands. And it is much the same with deep religious conviction. God speaks through Nature to the farmer, the fisherman, or those who brave dangers or labor in silence to overcome material forces. I do not think any man can take a poor farm, upon which some one has failed, and restore it to strength and fruitfulness, without absorbing, perhaps unconsciously, a deep religious conviction.

These things and more show why the man and woman crop upon our farms must supply a vital need of the world. I speak of them because you Institute speakers and workers represent a form of farm education which is closest to the farmer. The college and the station stand off at arm's length. You meet him face to face. You will make a great mistake if you fail to make much of the home. Many farmers believe in homes. They will drain a field to make a good home for alfalfa, put up a fine barn to make a home for cattle and horses and give the herds and the hogs all the comforts of home, but stop there! It is your business to keep them going with this home proposition—right into the house. I had a man tell me once that he believed in making the best possible homes for the stock, for that brought in money. He was afraid if he put corresponding comforts in the house his children and wife would become lazy and soft. That man explained to me a fine plan for piping water to the barn, so it was always before the horses. When I asked him if the water was piped to the house, he said "No; the women can go to the well; they need the exercise!" Now it ought to be your chief business to study how to make such farmers see that the human home is the most important of all.

Perhaps some of you have read "The Octopus." In that book is a German character called "Bismarck." This man was ever talking about the Fatherland and how he would go back to it. He finally married an American girl, bought a small piece of land and made a home of his own—becoming a citizen. He had no more to say about the Fatherland and some one joked him about it. Here is his answer: "Der Faderland? You ask me vere iss der Faderland? Were my home iss—vere I work mit my hands to earn the bread for my wife and family—vere I build the roof to shelter dem—dere is der Faderland!" I tell you that this ignorant German had in his heart the true philosophy of living. I wish you men and women could have the same spirit as you go up and down the State into lonely places or to sad or discouraged people, so that you could carry the true message to them. Let us not go about our work hesitating, or with an apology, but say, as we must know, that the best things that go with farm life are those which are closest to the home.

ALFALFA IN PENNSYLVANIA.

By PROF. ALVA AGEE, *State College, Pa.*

Director Martin has asked me to discuss the importance of alfalfa as a feeding and fertilizing crop for Pennsylvania and then my friend Peachey will tell how to grow it.

Some good people are affirming that all this talk about alfalfa is wasted effort in Pennsylvania. They believe that the crop has no importance for our state because it cannot be grown successfully. There have been a great number of failures—no doubt about it—but

these failures were largely due to our ignorance and not to any inability of alfalfa to grow if given a square deal. The proof of this fact is found in the existence of prosperous fields of alfalfa on a variety of soil types under our eastern climatic conditions. The plant does grow under Pennsylvania skies and all it asks is that it have drainage, fertility, lime, inoculation and a good seed bed, where it can have moisture and freedom from pernicious grass the first year.

A recent circular issued by the Ohio Experiment Station contains this statement: "Alfalfa is being grown with more or less success in every county in this State; with greater success upon the rich and well drained limestone soils of the western half than upon the shale, clay- and sandy loams of eastern Ohio, although under these less favorable natural conditions success has been obtained by many." A similar statement may be made for our own State.

Alfalfa would have no importance for us, regardless of the matter of the feeding value of a ton of alfalfa hay, if it would not grow on our farms. It is growing and can be made to grow on a very considerable acreage within our own state lines.

Our next consideration is its actual feeding value. On this point I can render the best service to you by quoting from Dr. Hunt's book on "Forage and Fiber Crops in America," which occupies an authoritative position in our agricultural literature. It says, "A table based upon the twelfth census and American analyses and digestion experiments, shows that in 1899 there was produced in the United States, about the same quantity of alfalfa hay as of red clover hay, off of about one-half the area, and that the yield of digestible nutrients was from two to two and one-half times that of red clover; while the digestible protein in an acre of alfalfa was three to four times that of red clover, and about ten times that of the cultivated grasses, on the basis of the composition and digestibility of timothy hay."

Experiments have demonstrated that the composition and digestibility of alfalfa are quite similar to that of bran. It is a safe statement that one ton of alfalfa hay is equivalent in feeding value to four-fifths of a ton of bran. Dr. Voorhees at the New Jersey Station has shown that nearly seven tons of cured hay may be produced on an acre of land in our Eastern States, when conditions are made entirely favorable. One-half of that yield, or three and one-half tons per acre, should be a low average yield on Pennsylvania farms, and if each ton is equivalent in feeding value to four-fifths of a ton of wheat bran, as scientific experiment has established, the importance of this crop for Pennsylvania is beyond question. Our agricultural leaders are right in their continued insistence that farmers learn to grow alfalfa successfully, because the relative value of alfalfa as compared with timothy and clover, cannot be ignored by farmers whose product in milk and meat must be marketed in competition with producers from other states who will learn to grow alfalfa extensively.

Director Martin has requested that the fertilizing value of alfalfa be discussed. One of the best examples of the use of alfalfa as a means of maintaining soil fertility, may be found on the farm of our friend Joseph E. Wing, where, in four or five years rotation, the alfalfa sod produces immense yields of corn. This legume provides a

soil with a large amount of organic matter and with supplies of nitrogen, and performs the same office as red clover. When mineral fertilizers are freely used, maximum crops always are possible on an alfalfa sod.

ALFALFA: HOW TO GROW IT SUCCESSFULLY.

By J. H. PEACHEY, *Belleville, Pa.*

The value of Alfalfa—"The Best of Fodder," has been practically demonstrated by Prof. Agee. It would be difficult to over-estimate its value as a forage crop. Truly it is the most wonderful plant in existence. You have learned what it is. I have the difficult task of teaching how to secure it. To have and to hold is the problem. My experience, limited to four years, directed by what I have gathered from other sources, will compose the subject matter of this article. So much has been published in book, bulletin and paper, that to gather the best information from the best authorities, would be impractical upon this occasion.

The soil, the all important factor in the problem, will first engage our attention. If soil is adapted to the plant, success is more easily obtained. Therefore a knowledge of the life history of alfalfa seems necessary. When we know the characteristics of a plant, we can work more intelligently. Alfalfa, being a dry weather plant, or one that succeeds best where the average rainfall is considerably less than in Pennsylvania, is not adapted to a wet soil. It cannot live in a soil where water excludes the air. Dig a hole in the ground several feet deep, and if water stands in it, alfalfa refuses to grow. The roots cannot come in contact with the soil air, and must necessarily perish. Some one has said that it will not grow on high ground. My experience teaches differently. One of my fields is on a hillside, almost the highest point on the farm. The growth is comparatively good. The soil is flint underlaid with limestone. At several places the yellow-limestone clay comes to the surface. Here the growth is apparently as good as elsewhere. The subsoil is reasonably porous.

Condition of soil is apparently more important than type of soil.

lime to the acre. This may seem excessive, but it cannot do injury to an alfalfa crop. Harrow with smoothing harrow about every ten days, or whenever you notice the appearance of weeds. Cut the soil shallow. Deep harrowing will bring seeds to the surface, that otherwise would be dormant. Continue thus until latter part of July or first of August. This should insure a well-prepared seed bed. A few days before seeding, apply about four hundred pounds of a good complete fertilizer. This can be done with a grain drill. If you can secure several hundred pounds of soil from another alfalfa field, do it, distributing it in the latter part of the day and harrow immediately. In getting soil, remove an inch of surface soil, and take several inches beneath. Do not expose this inoculated soil to the hot rays of the sun before applying to the field. Do not say that an application of inoculated soil is absolutely necessary, but it is a means to an end, and there is wisdom in securing the best condition possible. Do the best we know and leave the rest. My faith in inoculated soil from alfalfa field, is considerably stronger than in those commercial cultures, sent out by the Department of Agriculture. While I am free to credit to them full value, it seems reasonable to believe that when all other conditions have culminated favorably, alfalfa will care for itself. In other words, inoculation will not regulate difficulties that pertain to soil fertility, or create favorable conditions when good culture has been neglected.

Concerning the seed, get the best, regardless of cost. Patronize good, reliable seedsmen. Have seed tested for germination. Be sure that it is free from all noxious weed seeds. Remember that weeds and grasses are the persistent enemies of alfalfa. Prevention, like in all things else, is better than cure.

Time of seeding will vary with latitude. Prefer August 1 for Central Pennsylvania. Sow twenty to twenty-five pounds per acre. Quantity of seed will depend upon vitality and per cent. of germination. It pays to sow plentifully. Sow with seeder, one-half of amount each way to insure equal distribution. Cover with smoothing harrow. Seed at this season of the year should be covered at least two inches. I prefer the above method of sowing.

Considerable alfalfa is sown early in the spring with a nurse crop. Have no personal experience with this method. What knowledge I have of this has been gained from observation and study. Were I to sow by this method I would sow it with barley exclusively. Barley is an early maturing grain. It does not have an abundance of leaves to shade the alfalfa plant. For these reasons it is better adapted to this manner of seeding than oats. Sow a bushel of barley to the acre, and twenty to twenty-five pounds of alfalfa. Do not allow the barley to ripen. Cut it when grain is advanced to the milk state, make hay of it, or if small growth let it lie on the ground as a mulch. If allowed to ripen it will rob the alfalfa of moisture necessary for its continued growth. Remember the barley must be subservient to the alfalfa, if the latter shall be a winner.

During the first years' growth we clip the alfalfa plant. Time will vary with the season. If plants show indication of decay or premature ripening by turning yellow in leaf and stem, we clip it about four inches from the ground with the mower, leaving it evenly distributed over the ground. This revives the plant, develops a stronger root system, increases number of stems to the individual

plant, giving it that beautiful green tint, so desirable in vegetation. It also destroys many weeds, that otherwise would prove injurious to the alfalfa. Refrain from clipping early enough in the season, to allow sufficient growth for protection during the winter. The exact date connot be given. Judgment must be exercised in order to secure best results.

Another consideration is proper time to cut for hay. Just when a few blossoms appear is not at all times satisfactory. The other end of the plant needs to be consulted. Examine the plant carefully, and when the little sprouts have made their appearance, giving evidence of a future crop, cut it. We mow in the morning after the dew is off, sometimes followng immediately with the tedder. Never use tedder when alfalfa is dry. You thereby lose leaves, which are the most valuable part of the crop. When it is wilted a little we rake it in windrows. We cure it in windrows also. We turn it occasionally while yet damp, just rolling it over. All our efforts from first to finish, are directed toward saving the leaves.

This manner of curing usually takes three days. We begin piling when yet a little damp. Do not want water on it, only somewhat tough. Hay is put in barn before it is thoroughly dry. We do not want it to break. Unnecessary to have it perfectly dry. The moisture in the stalk will not injure it. It is moisture on the outside that causes trouble. If put in mow in proper condition it comes out with leaves and stems united. When too dry it breaks the stem in handling and leaves fall off. It becomes brittle and dusty. Stock does not eat it so readily.

Have no experience in the use of hay caps. Am gathering information preparatory to using them this year. From what I learn from others it is the right principle. No question whatever, that hay cured in cocks under cover, will contain more feeding value than when sun-dried. By this method but little loss is sustained by unfavorable weather. We once lost one crop because of rain daily for a week after cutting. At least three tons of alfalfa hay so badly injured that it was considered worthless for feed. Those three tons would have purchased a large quantity of material for caps. It would have been a safe investment—money well expended.

To the farmer who may peruse these lines, allow me to say that alfalfa is the most wonderful plant in existence. Did you fully realize its value, you would get the alfalfa inspiration, and get it awful bad. To you I say, select an acre of your best soil, the more nearly adapted to alfalfa the better. Manure it well. Plow it well and deep early in spring. Harrow thoroughly. Let it lie until weeds start. Harrow shallow. Make perfect seed bed. Continue thus until August 1. Apply fifty bushels lime. Secure soil from alfalfa

CARE OF MILK.

By DR. M. E. CONARD, *Westgrove, Pa.*

Milk is the best, most nutritious, and most easily digested food that has ever been entrusted to our care. It is the food that is provided for the new-born babe, when its delicate little digestive organs for the first time take on the responsibility of nourishing, sustaining, and developing a new being. Its chemical constituents and cellular arrangement is such that almost immediately upon entering the stomach, portions of it, undergoing little or no process of digestion, find their way into the blood and start the building-up process, as no other food does.

Nature has also provided a means of conveying it into the little stomach in its pure, fresh, warm and uncontaminated condition, the ideal of wholesomeness. This is ideal milk hygiene that insures purity and health. Does the implication of the word "pure milk" as so often seen commercially used on signs and wagons, give us assurance that we are being protected by any degree of "Milk Hygiene," comparable to Nature's plan in the feeding of our babies? No; the word "pure" has quite a different meaning.

It is generally used to convince the customer that an effort has been made by some one to prevent the introduction of, or to remove by strainer or other mechanical device, such material as may injure its keeping and market value. There is nothing said about its digestibility and nutritive value. The result of said effort is measured by a delusive measure, the length of time it will keep sweet and saleable. Now, if milk could be collected in such a way as to keep it perfectly clean and free of germs, it would not turn sour at all, but that is practically impossible, but the better care we bestow upon its handling, the longer it will keep sweet and wholesome. Milk to be of the best, must be kept clean from the start, but if once defiled, can never be corrected. If this fact was generally better known, and believed and practiced, the quality and safety of our milk supply would be much improved, without the aid of the many customs so common in the commercial handling of milk, which are paid for by the producer. I refer to pasteurization.

I do not deny that pasteurization has its place in the handling of milk, but I do claim to know that it is a good method badly abused at the present time.

As we all well know, pasteurization has for its object the destruction of all harmful germs, and that it has been learned that a temperature of 150 deg. F. for thirty minutes will destroy such germs, and yet has but little effect on the chemical character of the milk. It has also been learned that 165 deg. F. for thirty seconds will have the same germicidal effect. Now, the application of this method for commercial purposes has certain disadvantages or drawbacks.

First. That the process of holding the milk at 155 deg. for thirty minutes is so slow a process as to increase the cost materially, so the later-named plan of momentary heating to 165 deg. has met

with the greatest favor, and many machines have been built and are in daily use that are claimed to be so arranged as to permit of a continuous flow of milk passing through them, making the process much more rapid and short, and consequently less expensive. This seems to be a step in the right direction.

But the disadvantages are that it is difficult to keep the flow-of milk so regulated as to remain at the required 165 deg. F. for thirty seconds, and if it reaches a higher temperature there is imparted to the milk a cooked taste, which is objected to, and renders it not quite so digestible, and, also, this high degree of heat breaks up the fat globules, and more thoroughly emulsifies the cream, so that it never comes to the top quite so well as before heating, and the cream line does not show so distinctly on the bottle. This the customer objects to, and the dealer tries to avoid. He is very much tempted to keep the temperature below 165 deg., so as to preserve the cream line on the bottle, and much of it passes through without reaching the temperature.

It is true that the germs known as Lactic Acid Germs, that cause souring and curdling, are much easier destroyed than most disease germs, and even if the temperature does not exceed 150 deg. F., the souring germs are destroyed, and for commercial purposes it is very much improved by the prolonging of its period of sweetness, and the cream line is not disturbed. This is commercial pasteurization. It has removed the easily destroyed germs of souring, which are harmless, and probably not injured in any way the germs of disease that are left in the milk to grow and multiply, unobserved by the presence of the acid-forming bacteria, who by their presence do to a very considerable degree prevent the growth of other forms of bacterial growth.

I am not condemning a thorough pasteurization of such milk as has not been gathered under sanitary conditions, but is loaded with disease germs of dangerous kinds. But I do claim that commercial pasteurization as largely carried on is a farce in the eye of science, and a menace to the consumer who buys it in the belief that he is protected against the very element it is most likely to contain, the unrestricted growth of disease of harmful germs. And to the producer it is a daily expense; for the dealer is professing to do at an enormous expenses, the very thing that should have been done at the dairy by a better knowledge of dairy sanitation, and better methods in caring for the product, thus producing a better and safer milk, for which he should receive additional pay.

ALFALFA.

or even less than that. It is now seeded with alfalfa, and we except to make a little money out of it. When we went to rent the field, we asked the owner, what will you take for it; will you take a hundred dollars? Two hundred—four hundred—six hundred. He said the price of that land is \$1,000, strictly in cash, and we paid that thousand dollars. We will get this year, I suppose about five tons to the acre, so that we can well afford to pay that thousand dollars for the field. In fact, I rather feel that I am cheating my neighbor out of some of his rent.

Alfalfa is the coming grain, and I am pleased to see that Pennsylvania is falling into line. It is not planted in such large quantities as clover, but the acreage planted is constantly growing, and it points the way to larger things. Why, the limestone soil was created for alfalfa. A land that is dry, and won't fill up with water in the winter, that is filled with carbonate of lime, and is fairly fertile, will grow alfalfa, and big alfalfa at that. It can't fail to grow alfalfa. I advise you men who think you can't grow alfalfa to do a few things; first, get your soil dry. Why, we laid eighteen or twenty miles of tile draining in some of our fields, and in this very field that I have just told you of, we have already laid several miles. The land must be made dry; then it must be made alkaline with lime; along the fields of Pennsylvania I saw many places that are full of sorrel. Now, that is a pretty sure indication of an acid soil; to turn an acid soil alkaline, there is nothing that will do it so well as lime, and I prefer the ground limestone, rather than the acid lime. Now, after you have made that soil sweet and dry, and then made it rich and after that is done, inoculate your soil with soil from some alfalfa field or sweet clover patch, and then sow your seed in the spring or fall. I sow mine in the spring, and then when you fail—why, you simply cannot fail if you do these things.

Now I am going to tell you a story. Down in Virginia they have a river they call the Rappahannock. It is a quiet and slow old river, but at one time it was not so. Commencing at Port Royal, the country along its banks was settled the same time that Philadelphia was, and at one time Port Royal came very near being the capital of the United States, but at present it has a population of two hundred inhabitants, and one hundred and seventy-five souls. The streets are full of nice green grass, and the cattle keep it cropped. Now, along the banks of that river were born George Washington and Martha Washington. I visited their old home, and I tried to feel like Martha Washington when I sat in her chair, but I don't think I succeeded very well. Besides George Washington, President Madison—or was it Monroe? I am not sure—was born along the banks of this old river; it has been so long that I've had my acquaintance with these gentlemen that I've forgotten. Well, anyhow, I was on that river, the other day, and was surprised to find how the commerce of that noble river had shrunk. We would stop along our course, to take on a calf, or possibly two, but that was the exception. The folks who live along there are very fine people, very intelligent people, and I like them. Well, I went down to Port Royal, and found a country rediscovered, since the English discovered it several hundred years ago. It was rediscovered by a man named Jack, from Los Angeles, California. He came East in 1905, and stirred around the country a bit, and then he discovered this

old river. He had money; had got rich out in California, and when he came and discovered this old river, he took a fancy to it, and bought 1,700 acres of land on its banks. Most of this land had been abandoned as too poor to raise anything, but he set out to make an alfalfa plantation out of it. He knew nothing about the land here in the East; had never lived in the East. So he went to Washington, and then to the alfalfa department of the United States government, and said to them: "I have some land down here on the Rappahannock, on which I would like to grow alfalfa; will it grow?" "Oh, certainly," they told him, "it will grow; how much land have you?" "Seventeen hundred acres," he told them, "and I want to plant it in alfalfa." They stood aghast. "Seventeen hundred acres! Why, man, you must be crazy." "Well," he said, "what about a thousand acres?" They regarded that as colossal, and told him he would throw the alfalfa industry in the East back forty years. Then he came down to six hundred—five hundred—four hundred acres. But still they insisted it was too much; he must get that soil ready before he could grow alfalfa. This was not California, where it grew without any preparation. "Well," he asked them, "what must I do?" "Well," they told him, "first, you must lime it. "How much lime would I need for four hundred acres?" he asked them. "Suppose you begin with a hundred and fifty acres," they told him. "All right," he said; "how much lime for 150 acres?" They told him 400 bushels for the 10 acres. He put it down in his note book. "Now what next?" he asked. "Next you must give that land some phosphorus," they told him. "What is that?" he asked. "Something that is needed to enrich our Eastern soil," they told him. "How much of that?" he asked. "Four hundred pounds of bone meal to the acre," they told him. He put that down in his note book. "What next?" he wanted to know. "Well then you must inoculate the soil." So he got the 400 bushels of lime, and the 400 bushels of bone meal to the acre, and he limed it, and he made the soil fertile, and he got some alfalfa soil and inoculated that land, and then he sowed his alfalfa seed—150 acres of it, and he got 150 acres of the most beautiful green alfalfa. Next year he sowed 160 acres more, and got 160 acres more of alfalfa. This year he put six hundred tons of lime on that soil; to grow alfalfa. He has 320 acres of fine alfalfa, and about 1,500 acres of the finest crimson clover, which he is growing to turn in and grow alfalfa on that land. From his 320 acres of alfalfa he will grow 60 tons to the acre, and it cost him \$20 per acre. Now, it does not look reasonable or right for a man who has no need of money to come all the way from California and make money. I said to him "why are you doing this?" He said, "Isn't it worth while?" "But," I said, "I happen to know about your operations in California; haven't you got money enough?" He said, "Did anybody ever have enough? But it is not for money that I am doing this," he said; "I came down here and found these people so discouraged; they were scarcely making a living, and they did not have the money to educate their children in the way they themselves had been educated; I liked them, and I thought to myself, why not buy some land here, and teach these people how to grow alfalfa and give them a new start in life; now I have this alfalfa growing, and they come and look at it, and go home and try it themselves, and I have never done anything in my life that gives me as much

pleasure as this does. It is putting new heart into these people, whom I like so well for their kindness and intelligence. And any man who will make his soil dry, and make it sweet, and make it fertile can grow it."

POULTRY KEEPING ON THE FARM.

By HOMER W. JACKSON, *Cambridge, Ohio.*

The subject which has been assigned me for discussion today calls attention at the outset to the peculiar status of the poultry industry in our agriculture. We do not hear any serious discussion of horse-breeding on the farm, or wood-growing on the farm, or dairying on the farm as distinguished from production elsewhere, because no important effort is made to follow these industries anywhere save on the farm, or ranch. But while poultry keeping as a commercial industry reaches its highest practical development on the farm, it is so readily adapted to extensive conditions of space limitation, at least theoretically, that it is found more or less successfully established in all locations from backyards to ranches. This fact seems really to be something of a disadvantage to the development of the industry on the farm, because for a variety of reasons, it has resulted in developing methods and literature along lines that did not and could not meet the approval of farmers generally. As a result they have not had the interest in the industry which they would have had if the most approved methods had had a more practical development, and if the true status of poultry keeping had been clearly understood.

The general idea that poultry keeping can and should be more or less divorced from other farm work seems importunate. There will be in all probability a permanent and profitable place for exclusive poultry plant, but students of the industry are almost unanimous in the opinion that the most practical and profitable development will always be on farms and in combination with other lines of farming, just as has been the case with other branches of livestock. Generally the point seems sometimes to be overlooked that poultry is a branch of livestock farming. The current expression "live stock and poultry" is a misleading one, which we have reason to resent mildly. The same general principles guide the poultry keeper which obtain in any line of live-stock breeding. The same feed stuffs are used and in a larger or smaller degree the same results sought and secured. Many of the general advances in livestock methods reached their earliest acceptance and development in the poultry yard. It is not true therefore that the poultry industry is a live stock appendix. This point seems worth contending for, because I have the impression that much of the lack of appreciation of the industry on the average farm is due to the fact that its relation to other lines of livestock farming is not clearly recognized, nor is the magnitude of the industry appreciated.

Thanks to the enthusiastic favor of Secretary Wilson, it is now pretty generally known that the annual poultry income amounts to at least \$600,000,000, but to most farmers I presume that the statement that this industry ranks third in income production among all branches of agriculture and stands far in advance of any other livestock industry is as surprising and questionable. This statement, which is justified by the U. S. D. A. statistics, is not given by way of boasting, but, rather, to call attention to the possibilities which lie in the future. Because, in spite of its present magnitude, poultry keeping is as yet practically an undeveloped industry. What has been accomplished has been in the face of mistakes, discouragement and ridicule, and without any appreciation of the relation which the industry nominally sustains to agriculture. When farmers generally take poultry keeping out of the fad and pin money class and recognize it as an important part of the farm's livestock equipment, the annual production will reach sensational figures.

I am sure that at this point the question occurs to many, Why, if this is true are there so few successful poultry plants to give emphasis to these clauses? The statement carried in the question, that there are few successful plants is not exactly true. That \$600,000,000 income is in itself general proof of the existence of a multitude of these. Poultry is found on nearly all the farms of the country having a more general distribution than any other industry. The farm flock is, however, relatively quite small and hence of little value for illustration except in the aggregate. While it is true that the number of successful poultry plants of large size is yet quite small, there is not only not anything impossible about their successful development but, as the conditions governing their management come to be better understood, there is reason to expect that their number will rapidly increase. It is quite probable, however, that the great bulk of the poultry business will continue to be represented by small holdings rather than by large exclusive plants.

I do not undertake to recommend poultry keeping indiscriminately for all farms and all farmers. Many things must enter into the discussion as to what kinds of farming shall be undertaken, personal preference perhaps being more important than any other. But in comparison with other lines of farming the poultry industry has important claims on your attention. Small investment, utilization of waste land and cheap feed stuffs, light work adapting it to persons of limited strength, quick and constant returns, universal market, high market value of products, light weight of products and

ing for the development of this branch of the work to proportions large enough to make it important commercially will still be simple in theory, practical in application; that will utilize to the fullest extent cheap and waste feed stuffs and will make no extreme demands on the time and strength of the farmer and will permit the care of the flock to be turned over at least in emergencies to wife, children or hired man. There are many methods adapted to the varied conditions under which poultry is kept, but I know of no way which so exactly meets the conditions as above stated, as what is known as the colony method. This is recommended because it seems wise to adopt on the farm a method which, if carried out with ordinary care and attention to details, will result in the largest returns on capital and labor, rather than to adopt one which while it may show larger returns will be complicated and exacting and demand much more labor.

It is conceded that the colony method of poultry keeping, as applied to laying hens is not likely to result in maximum egg production. But after all it has never been proved that maximum production means maximum profit. Ordinary farm production is very low, because ordinary care spells neglect and it is possible to make important advances in production by the adoption of methods of care and feeding easily in the reach of any farmer. But when it comes to the extraordinary measures on which record breaking results depend it is not at all certain that much is gained. Certainly such methods are not to be recommended in general farm practice.

It would seem that the key to successful farm poultry keeping is the farm range. The man who has his flocks on a range has more than solved his problems, losses and labors, in addition to reducing his feed bill. And the location of poultry in flocks of suitable size on open range, in detached houses far enough apart to prevent much mixing of the flocks but with no house far distance from the dwelling or barn as a common center, is substantially the colony method. Exercise, green feed and meal food and variety in feeding, which are constant sources of expenses and anxiety to the intensive poultryman, are secured without effort during most of the year, and the otherwise waste feed supplies of the range help materially in reducing cost. Probably it is a mistake to attempt to make the range support the flock entirely, as that will generally result in limiting it to so small a number as to make the returns insignificant. The true idea in most cases would be to make the flocks large enough to maintain a production that would enable the farmer to make up commercially profitable shipments of stuff still fresh and in condition to sell on the best markets.

As applied to egg production which is much the most important and most profitable branch of the industry in general practice, this might mean keeping several hundred hens, which is easily practicable on most farms. The houses need be only of the cheapest and simplest construction, and should be large enough to accommodate 50 to 100 head or even more. Some successful farmers keep their hens in flocks of 200 and consider that number entirely satisfactory. This seems extreme but at least it shows the trend of development. The houses for several hundred hens, if properly distributed, may be far enough apart to prevent serious mixing of the flocks and yet all be within easy reach of the dwelling. Whenever possible they

should be so arranged as to permit the hens to enter and leave without requiring the attendant to open and close doors. Natural or artificial watering places will save a great deal of time.

The feeding method which seems best adapted to colony poultry farms is the dry mash, semi-hopper plan. By this is meant keeping before the hens constantly a dry mixture of ground grains in boxes or hoppers. To this is added in daily feeds as much grain and meat scrap as the condition of the hens seems to demand.

Opinions differ pretty widely as to proper constituents of the dry mash and the poultryman will find it necessary continually to modify his ideas of what should go into the mash to accommodate himself to the notions of the hens. In a general way it is found that a very fine mixture will not be popular and often better results can be secured by using a simple mash of bran and shorts, or what is known locally as run-of-mill, with about 10 per cent. each of oil meal and meat scrap added. Corn meal, gluten and other fine feed stuffs may be added, but usually their addition will promptly curtail the consumption, and in such cases is not to be recommended. The simplest way to feed this is to put it in a box large enough to hold 2 to 4 weeks' supply and deep enough so that the hens cannot scratch it out and waste it. Hoppers as generally constituted, clog or permit waste.

This grain feeding will vary with the season and the breed. Corn may well be taken as to basis of the grain ration and fed as liberally as possible without injury to the hens, as it is undoubtedly the cheapest, and within proper limits, the best grain for feeding hens. It cannot be used alone, however, with good results, nor should it be fed blindly at any time. Most of the year, however, a single daily feed of corn limited to an average less than two ounces per hen will be safe. If other grains are available and not too expensive it is well to use them in place of corn part of the time.

So far nothing has been said about breeds or hatching and raising the young stock, each of which demands fuller discussion than can be given now. Briefly it should be the farmer's time to stop with what he has, use pure fed meals and at the same time start a small pure bred flock with the purpose of replacing the grades with pure feeds as rapidly as possible. The particular need to be kept may well be left to personal preference. Artificial hatching and brooding methods are much more satisfactory than the natural way if successfully accomplished. Success however is an individual victory and for the encouragement of those who are not successful or do not want to pay the price of victory, I want to say that for the flocks

cracked corn and meat scraps and add one feed a day of wheat or other grain and one of wet mash. These daily feeds can be omitted of course, but it is very doubtful if it is wise to dispense with the wet mash until chicks are full grown.

In conclusion, I want to mention the most important objection likely to be urged against keeping flocks on open range, which is the damage that they may do to farm crops. Now hens do not damage crops unless they are hungry, and the way to prevent crop damage is to give more feed. If the hens can get at the poultry house what they might damage in the field, they will let the fields alone. For several years we have had crops raised on the shares on our farm. The man who does the work is given to understand that the hens have the right of way and will in no case be confined. But he is also told that if they damage his crop we will pay the damage in full and he can set his own price. In many years experience he has never asked for a cent of damage. There has been usually a little damage done right around the houses, but the man has always contended that the hens have saved him more by destroying grubs and injurious insects than they have destroyed in the crops. We have accomplished this simply by seeing to it that the hens found at their houses plenty of the grain sowed or ripening in the field. Such feeding is heavier than really necessary on the range, but it only needs to be continued a short time till the sprouting grain is out of danger or the ripening crops harvested and in the aggregate the extra cost is slight. The garden and house yard must of course be fenced, but that is the only special precaution that needs to be taken.

POULTRY LIGHT FOR THOSE WHO SIT IN DARKNESS.

By CHARLES T. CORNMAN, *Carthage, Pa.*

Mr. Chairman and Friends: I call you friends for the fact of your assembling together at this institute shows your great interest in all those things that pertain to the betterment of Agriculture, and if you are interested, then indeed and in truth you are my friends and the friend of every wide awake and up-to-date citizen of this great State. It is not my custom to speak from manuscript, but when I appreciate the fact that my audience was made up of the bright lights in agriculture of this and other states, I thought best to do so. It has been my pleasure to do considerable educational work at institutions of learning and institutes of other states. I regret that this is my initial bow to an audience in my own state. I can but credit the reason to the fact that a prophet hath but little credit in his own country.

It was my great pleasure a short time ago to view that grandest of all scenic productions, "The Creation." So great and grand and inspiring that one was lost midst the darkness and the stillness and the mystery until forgetting ones self the century seemed to roll back, back, back to the very beginning of things temporal.

Out of the midst of the great darkness and stillness came the sound of a voice, musical, deep, one sweetly tuned in the harmony of oratory, "In the beginning God created the Heavens and the earth, and the earth was without form and void, and darkness was upon the face of the great deep and the spirit of God moved upon the waters and God said let there be light."

Across the darkness flashed a silvered ribbon quickly followed by golden clouds. In a moment, in the twinkling of an eye the whole world was bathed in a golden flood, and there was light.

This is an age when all mankind is crying out for the light, and my mission here to you is to bring to you in my feeble way what light I can along those lines that lead to better poultry and more of it.

Poultry culture is but the silver ribbon across the darkened horizon, and I hope to see the day when the clouds will give way to a full burst of light and this country will awaken out of sleep and appreciate in its fullest sense what better poultry means to every man, woman and child in this greatest, richest and grandest of all countries.

Congressman Dawson, of Iowa pays this deserved tribute to the American hen. "Poets may sing of the glory of the eagle and artists may paint the beauties of birds of plumage, but the modest American hen is entitled to a tribute for her industry, her usefulness and her productivity."

The American hen can produce wealth equal to the capital stock of all the banks of the New York Clearing House in three months and have a week to spare. In less than sixty days she can equal the total production of all the gold mines of the United States. The United States proudly boasts of its pig iron, by far the greatest of any country in the world, and yet the American hen produces as much in six months as the iron mines of the country produce in a year. In one year and ten months she could pay off the interest bearing debt of the United States.

And yet in the eyes of the great majority, the American hen is here only because she is here. In considering one of the great problems of the day, the necessary food supply of this and all other countries, the hen has always been an important factor. What she really contributes toward the support of the eighty millions of people in our own country it is difficult to estimate. The value of poultry products is estimated at five hundred millions eight hundred thousand dollars, calculated as follows: The farms in 1905 eggs based on information at hand two hundred forty millions nine hundred thousand dollars. Poultry based in a like manner three hundred fourteen millions four hundred thousand dollars, a total of five hundred, fifty-five millions three hundred thousand dollars. In villages the value of poultry and eggs is estimated at forty-five millions five hundred thousand dollars, making a total as above. In presenting the case to prove the above statement I would say if the summary of the above is accepted, it appears that eggs to the value of two hundred sixty-five million dollars was produced and sold or eaten in 1905. You must remember that this calculation is the home value of the product and not the cost of the consumer. If the value of the consumer was considered it would be at least 100,000,000 to the value of the product. This would bring the total value of poultry products of all kinds as sold to the consumer to the enormous sum of \$600,800,000.

Through the records kept by the commission houses, there can be traced nearly two thousand million dozen eggs gathered and sold during 1905. This would be considered an enormous number of eggs were it not that it provides less than one egg per day for the inhabitants of this country.

In dividing the sections of the country we credit the dozens of eggs sold to each locality. In this estimate it is surprising to notice that Missouri is in the lead with 85,000,000 dozen eggs, Ohio which is not usually credited with equal importance in poultry matters to other states has a credit of 81,000,000 dozens of eggs produced. The order of production of a few of the largest producers would be as follows: Iowa first, Ohio second, Illinois third, Missouri fourth, Kansas, fifth. The North Atlantic States, including New York, New Jersey and Pennsylvania, do not stand near so well in the egg production as do the North Central States. Out of the billion and quarter dozens purchased during the year in this country, Ohio, Indiana, Illinois, Michigan, Iowa, Missouri, the Dakotas, Nebraska and Kansas produced 716,000,000 dozens, considerably more than one-half the entire production of the country. American people are the heaviest consumers of eggs in the world. Allowing a population of 80,000,000, the product of eggs for 1905 would provide about \$3 worth of eggs per capita to the entire nation. You will probably be astonished to learn that England imports \$40,000,000 worth of eggs and poultry into her immediate country. Of these the greatest amount comes from countries as follows: Russia sends \$15,000,000 worth, Denmark nearly \$1,000,000 worth, Hungary, Italy and France follow according to the mention of their names. Only about \$5,000,000 worth of poultry is imported. This comes from Russia, Belgium, France, the United States standing fourth in line. Russia sends about \$1,000,000 worth of dressed poultry into England. Ireland produces \$20,000,000 worth of dressed poultry that was sold for market. The total value of poultry and eggs consumed in the United Kingdom was about \$1,000,000,000 of which eleven-twentieths is produced in the empire, the balance sent from other countries.

A lesson of considerable interest may be drawn from this information. Russia the coldest, and considered to be the least advanced in livestock matters sends more poultry and eggs into England and Germany than all the balance of the countries. We have always claimed that the United States was the largest producer of all kinds of poultry products in the world. If Russia can supply her own demands for eggs and send samples amounting to nearly \$15,000,000 into England and a greater amount than this into other countries, what have we to say who claim to be the poultry exporters of the world when we face the fact that we are not exporters but importers of eggs, and that we only send to the United Kingdom \$1,000,000 worth of poultry products in an entire year. Another matter of importance in the value of the products. In the eggs imported into England, those from Denmark stand first as to quality and price, Canada second, France third, Belgium fourth, Germany fifth, France and Belgium very close together. It is a pleasure to learn that with all deference to France and Belgium, Canada stands second and must send their eggs four thousand miles across the ocean to meet in competition with those from near by countries that can reach London in a few short hours. Let the American farmer consider

this proposition thoroughly and take hold of the growing of poultry in a manner that will improve both quality and quantity so as to bring the quality up in advance of all other nations and at the same time have quantity to supply the world.

So much for generalisms; but how about our own State. The poultry products of Pennsylvania amount to sixteen million three hundred nineteen thousand nine hundred sixty-eight dollars yearly, quite a tidy sum, but far from what it should be and what it can be. When we consider the fact that the State has invested in poultry stock three hundred dollars, in buildings two thousand dollars, in equipment five hundred dollars, and pay for maintenance and salaries twenty-two hundred fifty dollars, making a total of five thousand and fifty dollars, we note the fact that this State receives thirty-two hundred thirty-one dollars and sixty-one cents for every single dollar expended and I have included the permanent fixtures. The State pays for horticulture one dollar for every nine hundred fifty-six dollars eighty-one cents received, and for dairy one dollar for three hundred thirty-three dollars fifty nine cents received. There is a striking lesson in the fact that vastly more people are engaged in poultry culture than are in dairying and horticulture, and yet they are always given the precedent. As a general thing agriculture in most of the states (and I do not except Pennsylvania) is compelled to take but the crumb that fall from the rich man's table, and poultry culture gets but few of the crumbs. The object lesson given the country during the business depression of the past several years, when, had it not been for agriculture with its millions of reserve, the load would have been almost beyond the power of this country to bear, should bear fruit an hundred-fold and place agriculture where it belongs, at the very head of nation and state.

The Keystone State consumes five times as many eggs as she produces. Of course Pennsylvania does export something toward the East, but a mere trifle compared with what she imports from the West. There is a single wholesale grocer in the city of Pittsburg who handles an average daily of three hundred cases of eggs of thirty dozen each. He pays out for eggs about half a million dollars each year. How many Pennsylvania farmers participate in this handsome sum of money. Not one. Every egg that this man handles comes from Indiana, where careful buyers gather them from the farmers. He says "the Western Pennsylvania farmers do not produce enough eggs, especially in the winter, for me to bother with. Of course I would rather buy home eggs, but I must buy from people who have eggs to sell." This man pays good prices. He handles fresh eggs only. He has no use for cold storage eggs. He would pay higher prices if he could get a constant supply of nearby fresh eggs. From September to first to March first a period of six months, the wholesale Pittsburg price will average thirty cents per dozen again that the man who can produce eggs at all in this district in these six months does so at a food cost of not over ten cents per dozen. In what other line of animal industry can one find a larger margin to pay for the labor and interest on the cost of investment. Eastern Pennsylvania demands even a better quality of poultry and eggs at still higher prices. The better class residents of Philadelphia and New York are each year becoming more fastidious as to the quality of the poultry products they consume and less careful

as to the prices they pay, provided the quality is above reproach. Not only in the two cities named, but in a dozen smaller cities are people who contract for their eggs six months at thirty cents per dozen and six months at forty-five cents, just so they get eggs that are strictly first class. In New York last winter I saw eggs put up in cartons and marked "strictly high class fresh eggs for invalids; price \$1.00 per dozen," and those eggs come from my home town of Carlisle, Pa., and if I were to tell you that these parties shipping them does not produce an egg, but buys them from the farmers you would evidently be surprised, but such is a fact. They buy all the fresh eggs possible to get, and never place a dozen on the market for less than ten cents above the market price. How do they do it? Every egg is candled, washed, selected, of uniform size and color, packed in a neat carton and strictly fresh, and are shipped to Hotel Waldorf-Astoria, Delmonicos, Park and Telford, Woman's Exchange and similar places that will pay any price for the very best, for the reason that they get the very best prices for such eggs. Why does the average farmer sit with his eyes blinded and permit parties at second and third hand to make the money that should come direct to him.

Again Pennsylvania is furnishing a constantly increasing demand for more table poultry of first quality. One has only to loiter around the commission houses to learn that most of the dressed poultry consigned will not rank above third-class, and that first-class poultry sell more readily and for twice as much money as poultry that grades only third-class.

To illustrate how determined people of means are to have poultry and eggs of the very best quality, I could name a number in the different states that have erected and stocked valuable poultry plants only for production of what first class poultry and eggs they want for their own consumption. There is a plant building now at Allentown by the Cement King of America that will be stocked with White Leghorns for eggs, with White Indian Game and White Orpingtons for broilers, and White Pekin ducks and White Holland turkeys, and all he asks of his manager is that his home be supplied with strictly first class eggs and poultry. Do you think this man would bother if some wide-awake farmer could produce just what he wants? Decidedly no; and he would pay any price for them.

A woman of my acquaintance has been supplying fresh eggs and dressed chickens to some of the best families of a nearby town. She assures me that during six months of each year she never sells an egg for less than two cents, and during the remaining six months for never less than three and one-half cents. Her uniform price for dressed chickens is 25 cents per pound, and she assures me that there are families that have not failed her a week in three years to take from at least two dozens of eggs and one chicken. She has constantly a waiting list of families anxious to get their supplies from her. She goes to town every Tuesday and Friday of the year and she so manages her flock that each market sees her ready to supply not less than twelve dozen of eggs, not less than ten dressed chickens. Her poultry flock brings her an income of fully fifteen hundred dollars per year. How did this woman get her trade and how did she hold it? Simply by learning how to produce a first-class article and by never marketing an egg or chicken that she cannot guarantee as

up to her high standard. Could she hold her customers year after year if she supplied them with eggs such as you see in the average farmer's basket, some white, some brown, some large, some small, some rough, some smooth, some clean and some dirty? Not at all. You could tell at a glance that she had a mixed flock of mongrels and that a chicken was a chicken and an egg an egg on that farm. Could she hold her trade on dressed chickens if she marketed them in bad condition, some white, some yellow, some fat, some lean, some neat and some mussy? She studies the wants of her customers and she knows what she wants and does her best to produce it. The great trouble with the average farmer he does not study the demand of the market. They will not take the trouble to learn the difference between a first-class article properly packed and a third-class article poorly packed, and then the cry goes up of the poor prices realized. The greatest obstacles that now stand in the way of profit from poultry on farms in this State are mixed flocks, poor houses, bad feeding and careless marketing.

Universities and colleges are doing much to dispel the clouds that hide the light and cloud the vision of the farmer and villager, but it is up to the states to take the matter well in hand and solve for them the problems. I am glad to note that this State has taken the matter under consideration, and for the past few years poultry culture has a place on the Farmer's Institute programs of the State, and is being recognized as a very important branch of agriculture. When one considers what it means to the State, it is difficult to understand why it has been so thoroughly neglected. The average egg production of the mongrel hen is eighty-two eggs per hen per year. The average weight of the mongrel chicken is three and one-half pounds. Now what is the problem for the State to solve? The farmer must be educated to bring the average of his flock up to two hundred eggs per hen per year and the weight of his fowls to five and one-half pounds each. I want to show that as a business proposition for the State it is one of the greatest ever presented of them. If you can increase the egg production eight eggs per hen and the meat production one pound per chicken you have added to the wealth of this State more than a million and one-half dollars. And I want to say that it can be done in two years time. This is an intensely practical age, and one must go at the farmer in a practical way. What does the average farmer care to know the amount of ash, crude protein, carbohydrates and fat in corn or wheat or oats, and what the nutritive ratio is. He don't care a rap to know the amount of gas generated during incubation or the amount of moisture absorbed by the chicken. What does he care about the composition of the egg or chicken. What he wants to know are the plain facts as to how best to get results. In other words the farmers of Pennsylvania must have a primer of Poultry Culture to be compiled in parts and made a reading course in which every phase of plain practical poultry culture is

I cannot close without a short comment on one of the industries in which Pennsylvania is so largely interested, namely the Pekin Duck industry, and one of which she can be greatly proud. The duck season closed about September first, and the raisers enjoyed a very good one.

Green ducks did not go below sixteen cents per pound and the minimum of price covers a good margin of profit. Green ducks come into the market late in April, when they command a price of from thirty to forty-five cents per pound. By green ducks is meant ducklings averaging about ten weeks old and weighing from four and one half to six pounds each.

Long Island, N. Y., now markets more than 350,000 green ducks each season. Neck to neck with Long Island comes Pennsylvania. In computing the numbers raised at the seven largest ranches, I find them producing 325,000. Taking the smaller plants into consideration throughout the State, Pennsylvania now stands first.

There are several ranches in New Jersey and several in Massachusetts. A number have been started in more western territory, some of which have been very successful.

Four have lately sprung up in Michigan and Ohio, two of which are near Detroit.

The West for some reason has failed to develop this industry and we find no ranches near Chicago, St. Louis, St. Paul, Minneapolis, Kansas City, Denver, etc., but naturally, this market will come in time. We find Long Island and Pennsylvania ducks advertised in the above named cities, and they find ready sale. Taking the average for the past year, we find the output of green ducks to be at least ten millions of dollars.

I have been asked to give you in a concise way the best way to interest and drive home the best facts to the farmer at the gatherings at which poultry interests are discussed. I can only speak from my own work. I find that the farmer and student wants practical facts, and he will take them home with him and apply them to the best of his ability.

The first thing I say is, "well, boys, how many of you have note books; hold them up so I can see." What, only four or five; get some paper every one of you and make notes of what I say. Don't you know that the way to remember a thing is to make a note of it; so sure as you do that you will never forget it. How many of you have the old time mongrel fowls on the farm. Noted. How many of you have mixed flocks? Noted. How many of you have pure-bred flocks? Noted. Don't advocate the immediate disposal of the mongrel and grade flock as so many institute workers do, for you have the farmer's stinger out at once if you do, but show him plainly how he can bring his mongrel flock up to grades, and how he can bring his grades up to pure breed and with the investment of very little. Explain to him the best egg type and the best meat type of fowls and tell him how to select them. Tell him how to pick out the laying hens from the drones. Tell him how to select his eggs for market, and how to dress his fowls. Tell him how to feed for best results. Tell him how to set a hen and how to care for the young chicks. Tell him what to do for gapes, for cold, for croup, for cancer, for lice.

Then have him ask you any question that comes into his head and answer it for him, and he will take home with him a storehouse of poultry knowledge that will ever do him good and such as he will make use of.

POULTRY HOME CONSTRUCTION.

By W. THEO. WITTMAN, Allentown, Pa.

In listening to the speakers ahead of me this afternoon, you have gained some idea of the immensity and the importance of the poultry industry. And yet I wish to say here, that few people on the outside have any real conception of what the immensity and importance of the product of this industry is. As an illustration, rarely quoted, take the matter of eggs annually going into cold storage. I understand up to this time this year no less than three and a half million crates have thus been put away. Three and a half million crates is one billion, two hundred and sixty million eggs. And to supply the tables of this State of Pennsylvania there is going to be paid out something like sixteen million dollars for such eggs next fall and winter. You deduct from this that many somebody's are missing golden opportunities to produce and sell practically unlimited quantities of new laid eggs in these months, at practically their own price, for there is a strong prejudice against cold storage eggs, so strong that a large per cent. of these hundreds of millions of dozens of eggs now in cold storage are going to be sold as "strictly fresh." To figure out where all the eggs get to, you must allow every man, woman and child in this country considerable over one egg each per day, every day in the year.

There are immense possibilities in the poultry business, and the conditions are yearly making it possible to get bigger and larger profits out of the business. Or, take it as a side issue, or as simply poultry keeping on the farm and not as a business, a condition likely always to exist in a majority of our farms; I am entirely sincere when I urge and insist that for many of our farmers it would be a better living, if more of them would pay more attention to poultry.

of 1907 I came across a poultry house built against the side of a hill with a sheer north, north-west exposure. To the south there was a belt of woods and a building of two, forming a pocket, effectually cutting off the winter sunshine. Although the season was well advanced, there was still snow and ice right up to this poultry building. For convenience, but aggregating the conditions, the large door, the fowl exit and the window faced the north. In that flock there were several hens with toes frozen off and one hen with toes so entirely gone that she was hobbling around on two stumps. Take the opposite extreme to this: Last winter in company with a brother poultry judge, we had occasion to take a trolley in Lancaster county to the home of one of its much respected farmers. This man had splendid out-buildings, as is the usual rule in this county of big red barns and other out-buildings to match, and he told us his poultry house cost him in the neighborhood of \$800.00. It was built forty feet square with a four-sided roof rising to a peak. The entire four walls of the building were glass and there was not a bit of ventilation, and in spite of the fact that it was a bright, sunshiny day, the poultry was confined to the house, which was at that hour nearly or about summer temperature, and on account of continuous lack of ventilation, very damp. There were between two and three hundred head of hens, and I doubt if there was one that was not sick; colds, distemper, roup and liver complaint seemed to be the most prevalent; a catalogue of ills to discourage the most enthusiastic.

Now take another poultry house, on a hillside within sight of my own city. I had known it for years and that one of the scrubbiest and dirtiest flocks of hens within my knowledge owned it as a home. The house was a square, eight or nine feet, with a shed roof, no window or opening, save a door simply for the man to enter. The thing must have been fearfully overcrowded at night, but there was no entrance or exit for the poultry, save a hole scooped out from under the sill. Well! I had no business there, but one day I boldly went up and opened the door. Nests, roosts, walls, were covered with excreta. There was nearly a foot of this on the floor and the odor that greeted me was nearly as thick.

There are variations and modifications of this on our farms, usually not as bad often not very much better. Broadly, the trouble with many of our poultry buildings is that in their location and construction, there has been too much original originality. I find that usually inexperienced, wrapped up with the vanity or egotism of such a simple thing as a poultry house, or slavish imitation of poor examples was the guiding spirit.

Now, again, from time out of mind, the poultry back on the farm has shown a strong disposition to roost out of doors the year round. This was not, in our northern latitudes, conducive to winter egg production or even profitable poultry keeping. Hence arose the idea which has gained universal acceptance, that hens to lay well and do well in winter time had to be kept warm. And that a tight house meant warmth, particularly if a lot of glass were used. Now, the tighter the house and the larger the area of glass the poorer were the results, and many and many a dream of wealth in the poultry business has gone glimmering where such construction was followed. Colds, distemper, roup and a whole train of poultry ills or well-named "house" diseases were endangered, and there was nothing doing.

Some bright mind reasoned out the analogy of this and thus has evolved the curtain front, fresh air house; the sort of house I have previously spoken of as one of the prime factors in making it possible now to go into the poultry business as a business and stay in. That's strong indorsement enough, although I could easily spend an hour quoting endorsements and examples of the wonderful possibilities and results in this kind of house. Allow me here, incidentally, to refer to the great outdoor and fresh air sleeping movement in the human family; or how fresh air and sunlight (the companion of "fresh air" poultry house) are considered the prime requisites in our modern sanitary cow-barns.

The curtain front, fresh air poultry house idea probably originated in the New England States, and it is there this style of house is at present most in use and most believed in. I am stating this so that at the outset you who sit in front of me, may have your minds set at rest as to its practicability in the latitude of our own State. If hens lay and do exceedingly well, better than by any other method of housing, on the bleak New England hillsides, then they will do equally well, and do, in wide open or curtain front houses in Pennsylvania.

Pardon me for citing some of my own poultry of this last winter at this time to clinch my point: On account, partly, of being away from home continuously, we had only two dozen White Leghorn pullets at the home place. They were in absolutely wide open, to the south, houses all winter, not even a curtain; were constantly fed all grain in deep litter and on account of Mrs. Wittman wishing to spend some time with her mother frequently fed only once a day and occasionally only once in every two days. This latter did not entail the hardship it might seem for it meant the loss of only one mash feed, as the litter being deep it worked out the same results whether the grain was put in for one day or two days. In fact, in this litter grit, shell, charcoal and coarse beef scraps were fed to last a week at a time. Well! these pullets, twenty-four of them, from the 10th day of October to the 10th day of March, or five winter months, laid enough eggs that were sold at retail to pay a profit over feed of \$54.00, and not one of them had a frosted comb or a cold or roup or any disease, in fact, all of them were in high health and full lay every hour of the entire period.

ADDRESS.

By J. E. WING, Mechanicsburg, Ohio.

I wonder how many of you realize what a wonderful lot God has done for you here in Pennsylvania, in giving you this fine soil, with its lime and its fertility, and its trees and its grass and its streams? Sometimes we are so taken up in trying to get out all that soil will produce that we do not stop to think of these things, but some day we will have learned our lesson better, and will be willing to learn something from the old world where they have been farming a few years longer than we have. Talk about Pennsylvania being an old State! Why, the oldest part of it is now over two hundred and fifty years old; some parts of it are two hundred—down here around York, for instance—and some only a hundred years old, while over in Europe they have been farming the same land in many places for a thousand years, and do not think of it as exhausted.

Now, I want to tell you about a little farm in the old world that it was my pleasure to see a few years ago, by the way, Mr. Chairman, is this a chestnut? Well, anyhow, chestnuts are good; most of us like them; so I will go on with my story. I had been going over the country a good deal to see how they did things over there; I went over Germany and France, and when I came to France I went to the Commissioner of Agriculture, and told him I wanted to see the finest farm in France. "That is a little difficult," he said; "we have many fine farms." "But," I said, I want to see the most perfect one, the one that is run in the best manner, and that yields the best returns." He thought a while, and then said "M. Delacour is perhaps the best farmer in France, and he will show you many things." He sent for M. Delacour, who came to Paris to meet me, and we went out to his farm, which was about forty miles from Paris. About that time it began to dawn on me that I could not speak any French, and M. Delacour could not talk any English. Still, we conversed all the way from Paris to his farm. We would look out of the window, and when we saw something that we did not like, we would shrug our shoulders and frown, and when we saw something we liked, we would nod and smile, and we really understood each other very well. After a while, he waved his hand to show me that we were at his own fields; he had two thousand acres of the finest land I ever saw. Most of the farms of France are small, and it is a singular thing, I noticed, that where farms are small, the families are large, and where the farms are large the families are small; this was the case with M. Delacour; he had but one child.

We came up to his fields and found the wheat just ripe for the harvest, being harvested with a McCormick binder, drawn by two yoke of big, white and cream-colored oxen. I find that these oxen are worked for two or three years, and then sold. Then we came to a field of young clover, and then alfalfa, and then another wheat field, where the men, eight of them, with old-fashioned scythes, were just cutting the wheat. I took a scythe from one of the old fellows; the blade was rather short and very sharp, and I am afraid I was not much of a success in using it, for he frowned, and shook his head; I was not doing it right. I never saw such grass as they were cutting there—common red clover, and alfalfa and a rather high grass all mixed together. I would say that about one-half or two-thirds of it was alfalfa. Then the women came along with little rakes, and raked it into little shocks, like buckwheat shocks. Wonderful that grass was—wonderful! And then we came to a beet field where they

were growing sugar beets. Then another field of our Indian corn, or maize, as they call it in Europe. And then we went up a hill, and came to a little village of curious old stone houses, covered with straw, and on this straw were growing flowers in full bloom, looking very pretty. I learned that these were the homes of the laborers, who owned them, but not the land on which they stood. That belonged to M. Delacour. Finally, we went through a great archway in a high wall, and came presently to Delacour's castle. All along the east side of the great mass of stone was a stable—a great stable—where, at one time, I suppose, the soldiers quartered their horses, but which was now devoted to sheep, and those two thousand sheep there, were exactly two thousand healthy sheep. They had plenty of fresh air and dry clean straw, and you never saw more splendid sheep. On the other side of the great building was a large stable devoted to cows—dual purpose cows; if he had been here in Pennsylvania the Institute speakers would have told him that was wrong; he must not have dual purpose cows, but must have one cow for milk, and another for meat; but M. Delacour was unfortunate enough not to know anything of Farmers' Institutes! And then, on the other side, was another stable of splendid Percheron horses.

And when we went on into the house, where we found the governess of M. Delacour's little boy; she spoke some English, and acted as interpreter for us. I never saw anything quite so elegant as that old house, with its collection of fine pictures, and old armor, and its fine tapestries, and every window of that old castle looked out on the courtyard, out on the three sides that were stables, and right in the midst of that old courtyard was an immense pile of manure, which must have been treated in some way, for I could detect no odor. Well, I could not help looking at that pile of manure, which was visible from every window, and every room of that magnificent old castle. Then the governess said: "Mr. Wing, you gaze upon that courtyard, and I see your eyes fall on the great pile of manure. M. Delacour observes that you look at it, and he says to tell you that it is a fine pile of manure, gathered since his father's day, and M. Delacour says to tell you that every time he looks at that pile of manure, he sees what makes this place here so beautiful. From that manure, pile comes the richness in the soil that feeds himself and all the men and women and cattle on the place." "But," I said, "why do you have it there; when will you put it on the ground?" "Just as soon as the ground is ready for it."

After a while M. Delacour and I walked out over the fields, and I dug my foot in the soil, and there was that soil that had been farmed for a thousand years—yes, these fields were old a thousand years ago—and yet they are richer than anything I ever saw in America. And then I said to myself, "Now, Joe Wing, you go home and see whether you cannot learn to do some farming. Grow alfalfa and clover, and feed it to the animals, and return that manure to your soil, and see whether you cannot get a soil as rich as this soil that has been farmed for a thousand years before you were born!"

M. Delacour had covered his manure pile over with fresh straw, and something to take the smell away; we still have some things to learn, in farming. Then he manured his land well, and used with it a soft lime, that he pulverized without burning, and that soil responded. And how that man loved his soil, and how glad

he was to see the grass and clover grow! That is one thing we need in America, more than anything else—love and gratitude to God for what He has done for us, and then we can make this world here to produce in such a way as the world has never known.

PROFITABLE SHEEP FARMING.

By MR. JOSEPH E. WING, *Mechanicsburg, Ohio.*

Ladies and Gentleman: Last week I had the pleasure of seeing the last of the sheep and lambs cleaned up on Woodland Farm, and shipped to the market. The lamb crop on that farm last year brought us about \$12,000. I was much pleased until yesterday, when my brother said "Joe, if we had saved those lambs until this week, we would have cleared \$1,500 more." I said, "Forget it."

In 1889 I came home from the west and took charge of my father's old farm, after having been cow-boy, rancher, and finally foreman of a large ranch in the west. The farm then did not have even two hundred acres, and you can imagine how I felt when I came home from one of the best ranches west of the Rocky Mountains, where I had been foreman. The foreman's stations on that ranch were forty miles apart, so you can imagine how small that little old farm of less than two hundred acres seemed to me. I was not there very long before I began to try to find excuses to go back, and what made it worse, I had a letter from the rancher saying "Joe, come back as soon as you get through with your visit." The amount of hay and grain on that old farm was so small, and the stock were so few! Father must have known what was passing in my mind, for one day he said "Come in here, my boy; I want to talk business with you," and he took me into the sitting room and closed the door. Then he took down the old account book—a mighty careful man was father—and there set down in black and white was the number of hogs and cattle, and the amount of hay and corn and wheat, and everything; what he had fed to the cattle, and what it amounted to—and when I saw the figures, my heart went down like lead, for it amounted to a little less than \$800, out of which the taxes, and the interest on the mortgage—for there was a mortgage in those days—had to be paid.—"What." I said to myself, "have I got to come down to grooming and currying horses, and doing the work of a farm laborer, all for \$800 a year?" But father said "My boy; this farm may do better if you take hold of it; I am too old, and hired men are not good for much any more"—I wonder do you ever hear that in Pennsylvania? "When you was a boy, I helped you, and now that you are a man, let me be a boy, and help me; I need you." I studied awhile, and then I said "Yes, father; yes, I will; but you won't care if I make some changes?" He said, "I don't care if you turn the farm upside down." That was in the year of 1890.

We walked down towards the barn, and the old sheep pasture; it was not fit to be a sheep pasture; it was wet and damp and cold, and full of crawfish holes. "Father," I said, "may I drain the field?"

Well, I started in, and dug ditches in that old field, and laid tiles in, and by that time I forgot that old ranch to which my heart had been turning all this time. Now some of you people who have boys that are not interested much in agriculture, turn them out into the fields, and let them get the mud of those old fields all over themselves, and you will be surprised to see how soon they learn to love that mud, and the fields that produced it.

Well, I got some tiles laid, and then I began to get interested in watching that old field get dry, and I said to myself, "Some day, old field, I'll get you dry, and make you rich, and then you will grow corn and build a home for the sweetheart." And then I looked at my watch, and it was sundown, and I wondered where the day had gone to, and then I went down to see the sweetheart whom I married next year.

After we were married, I said, "Dear, I am going to get a little bunch of ewes; father always had some, and they will help to make this old farm rich, and fertile, so that it will produce more." The sweetheart was willing, so I bought a little bunch of ewes from a man who said he would deliver them half way, if I agreed to take them the other half of the way home. So, in November, 1890, the sweetheart and I—we were married then—drove down in to the country to meet the ewes. We took the old buggy—I have it yet—and started down the road. Pretty soon we heard the little jingling of the bells, and there around the corner came the ewes, and then the sweetheart reached out her hand to me, and I reached out my hand part way to her, as married folks are allowed to do, and we squeezed them a little bit, and she said "Oh, aren't they pretty?" And then we went home, she driving the old horse, and I walking and driving the ewes. We laid lots of plans over that little bunch of ewes. We took them home, and everything I could read about sheep I read—and lots of foolishness, too.

Oh, I learned what a good thing wheat bran was for sheep, and I bought a lot of it; and I bought cornmeal, and grain, and everything else that was supposed to be good for sheep, and those ewes certainly did thrive on that wheat bran. They looked fine and strong, and then when spring came the little lambs began to come, and a pretty time that is! And these lambs were dandies! They came so large and heavy. Why, one of them weighed seventeen pounds when it was born; but its mother died, and then the little lamb died, because I did not know how to feed it. Then I began to see the trouble. I had fed those sheep until they developed too much bone and muscle. I had overfed on wheat bran. By the way, those that lived—and a good many of them did—made me money. Then one of my old neighbors who never overfed his sheep came around and laughed at me; he said, "Why, Joe, you overfed them; you should not feed them any bran at all. I turn mine out to pasture; sometimes I may have to feed them a little bit, but they take care of themselves. The next spring I got several hundred sheep to fatten, and then I followed the advice of my neighbor; I turned them out to pasture, and gave them fresh air and scenery—lots of it—and when the lambs came in the spring, they were a pretty good, live lot of little fellows. But the mothers did not care for them. I had not realized then that the ewe might be the very best, and yet not own her lambs, and then I learned this great truth, that a ewe that

has no milk in her udder, has no love in her heart. It would have been funny, if it had not been tragic. That old ewe would look at me until I could hear her say "Joe, here is a lamb or two; take them and feed them; I have no use for them." And then I began trying to feed them, and the sweetheart who had no children of her own then, tried to help me, but we made rather a sorry thing of it. And then I learned the great truth that in order to have love in her heart, the ewe must have milk in her udder. I get lots of letters, these days, and many of them say the ewe won't own her lambs; "what is the matter?" Simply write one word below that question, and send it to the writer—and that word is "starvation." I had gone to the two extremes, because I did not know better; first, I over fed and developed so much bone and muscle that the lambs had such a hard time being born that they died, and the mothers died; and then I had underfed so that the mother had no milk in her udder, and no love in her heart, and did not own her lamb, and they died for want of the mother's care. Of course, it is natural that you lose a certain percentage of the ewes and the lambs. When a man tells me that he had a splendid lambing time, and that his ewes and lambs all lived, I can't help but think of what the Psalmist says. "All men are liars."

It is a beautiful sight when the lambing season comes, to see the little fellows look up at you, and go to suckling their mothers. I love them; I love babies, and it is a mistake for any man to undertake to raise lambs who does not love them.

Then, when the lambs are here, comes the care of them. Out on the ranch, we had sometimes as many as ten thousand sheep, and out of the two thousand young lambs, there was not one that was not hearty and healthy. Why? Because they live as God wants them to live, eating naturally, with plenty of fresh air, protected only from the inclement weather.

Now, after they are born, what next? Teach them to eat something. We used to fix up a little pen into which to put the old ewe and her lambs, and get those lambs started eating. We started them on bran fresh ground from the local mill; we took forty pounds of cracked corn, and forty pounds of wheat bran and about ten pounds of oil meal, and got the little rascals to eating of it, and how they would eat, and how they would grow! The mothers were kept with them, and when she was a good mother, and had lots of milk—we fed the ewes well—how she would love those lambs, and how the little rascals did thrive and frolic. It was a delight to see them. There was a man in our town who complained that he never made any money out of his sheep, no matter how he fed them! Well, I saw that man go in to feed his lambs one day, and he went about kicking them right and left out of his way. I was not surprised that he did not make money. We made plenty of money out of ours.

We mix up plenty of rations, and then give them an ear of corn, to teach them to get out the grains for themselves. We do not allow them to eat out of the same mess twice; what is left over we give to the old ewe, who is not quite so dainty as these little fellows. When they got to be about eighty pounds, we would sell them into the market. The very last ones went into the alfalfa field, and very little corn was fed to them. I told you we fed \$15,000 worth this last year—hold on! We fed fifteen hundred of them, and they

brought us \$12,000. Most of these were not grown on the farm; we bought them last fall. We could not keep ewes enough on the farm—it is a little larger now, 320 acres—so we buy them in the fall and finish them. A pound of corn soaked in mother's milk will make a pound of meat on the lamb, and that brings us \$9.50 per hundred pounds, live weight at Buffalo—yes, more than that, for the shorn western lambs bring that. There is no fear that the market will be glutted, for the eaters increase faster than the lambs.

You fellows have too many automobiles to look after the sheep. I have fed all kinds of sheep—even Montana wethers. Our big sheep gained eight pounds over winter, while the little lambs, the tiny fellows, gained eighty pounds. Do you people know that the younger a baby is, the more he gains in weight in a given time? Why, I have three boys at home, one a little fellow, one pretty nearly as big as I am, and the other one nearly grown—I used to know how old they are—their mother knows yet. I fed them a whole year, and then take them down once a year to be weighed. I have given up weighing myself in disgust; there is nothing to be gained by feeding me; I seem to be getting poorer all the time. I put the oldest boy on, and found that he gained eight pounds; the second one gained ten; and the blessed baby gained twelve. The animal bodies are all composed of little cells—these doctors and scientific fellows don't let you forget it. I stand here, and I am Joe Wing, but I am more than that, I am the Republic of Joe Wing; composed of thousands of little cells, each one complete in itself, built up one by one to make me. These are very active little cells, and they want to grow and multiply and get bigger, and increase the number of cells in the body. It is a hungry body, because it is a healthy body. A body that is healthy is always hungry, because these cells need this food to enable them to reproduce themselves. When the body is nourished, these cells divide, and each cell makes two, and in that way it grows. What is hunger, any way? These cells need something to make them grow, and they notify the stomach, and the stomach telegraphs it up to the brain, and says "I am getting fits because you don't send enough to feed these cells down here." The stomach has higher duties than we have; it has to feed those hungry little cells, which straightway divide, and make two, four, eight, sixteen cells, and it is by the rapid increase of these cells that the body grows. Why don't you keep the hungry body fed? There is no money in keeping your blood poor.

A little corn fed these lambs now will pay more than a whole lot in the field, and more than a hundred pounds in two or three years. But how much corn? That is important. It is a pretty safe rule in feeding pigs or lambs, or anything else, to give them just a little less than they want. It has always been our endeavor to give them about three grains less than they want. Then they get hungry, and, oh, how good it tastes! If they have more than they want, there is nothing to stimulate the appetite, and it soon palls, and fails to taste good. And that is a pretty safe rule to apply to pretty nearly everything. Always go home five minutes before your sweetheart wants you to. When you come again, she is glad to see you, and draws a long breath, and says "Why, there is John! Come right in; I am glad to see you." But if you stayed five minutes longer than she wanted you, when you come again, she would look out and say,

"Oh, there's that man! He makes me tired." And it is just the same with the little lamb. When he sees that corn, he says to himself: "Here is something that I could never get enough of under my apron; it must be awful good, and cost a whole lot, because they never give me enough of it; I'm going to eat all I can get of it."

Now, the alfalfa hay; we give them all that they want. We used to feed that in the West, and I learned its value. Now, my brother is a little more economical in that respect than I am. He gives them practically all they want, but, just the same as with the corn, he stops soon enough to whet their appetite.

Now, as to the pens. We have two panels, about three and a half feet long, hinged together, so that we can set them down anywhere, and when the little lamb is born, we put the lamb and its mother in one of these little pens, so that they can become acquainted. How do you suppose the ewe knows her lamb? Not by sight, and not by sound, either. Now, I have seen a pretty sight many a time. Out on the ranch there would be on one side of the field five hundred lambs, and on the other side a thousand ewes. Now, the lamb knows its mother by her voice, and when he hears her calling he will say, "Thats my mother, and there's the dinner bell calling," and will run over to her, and find her. But the old ewe is not sure that it is her lamb, so she takes him and smells him, and if she smells her milk on him, its all right; that is her lamb. She knows him by the smell. Now the way I get a ewe to take a lamb that is not her own, I put the ewe in the pen, and fasten her down with little stanchions, so that she cannot butt the lamb, and the little lamb will suck her, and in a few days it will smell like her milk, and she will own it, and love it. Once in a while a lamb dies, and then we skin it at once, and put that skin on another lamb, and give it to the old ewe. For about a day or so, the old ewe worries about her lamb, just as you do about your child, and then she looks at the little lamb that has been given her, and she smells it, and begins to think there is something funny about it; it smells like her milk, and in a few days she will have taken that lamb, and loved it. I have never known that to fail, either. Lots of these little tricks are worth knowing. But I want to go on further. I might say, before I do, though, that we make a practice of turning the ewe over to see that there are no tags of wool hanging to her udder. If the little lamb should take any of these tags with his milk, he would get sick and die.

Anybody in Pennsylvania can raise sheep, but most of you have become afraid of stomach worms. Now, in 1896 I lost nearly all the lambs we had, and then I got busy and experimented a little. I was the first man in America who gave gasoline to the lambs, but we have not done that for several years. Now, I'll tell you something that will probably surprise you. My lambs chew tobacco like old soldiers. I do not allow them to smoke, because that is not good for them. But I'll tell you what we do. We get the tobacco stems from the factory—we can buy them for about \$2.50 per bale of 500, and the sheep love them, and in order to get them to eat, we dip these tobacco stems in salt water—not brine, just salt water, and then give them no other salt. And we are not bothered at all with stomach worms or parasites. I have never known sheep to have parasites that fed on alfalfa. They may bloat some, but we do not

often lose any lambs. Sometime ago I took a man out over my fields, and showed him my lambs, and I told him we had not lost any that year, when all at once, in looking over towards a pile of brush, I saw four little white feet sticking up to the sky; I quickly looked in the other direction, and said, "This is a pretty fine morning." And he left without seeing those little white feet pointing to the sky.

Another thing we do some years is to keep the lambs in the barn and soil them. It is surprising how much can be done and how little trouble it is to do it. Just give them some green alfalfa and then watch them lie down in the shade and eat it.

By the way, some of your young men who buy sheep and lambs may want to know how to find whether they are healthy. I will tell you. If you find them bright and lively, white, and pink around the eyelids and nose that is a good sign; pink veins—just catch one of them and hold him, but don't catch him by the fleece; I would just as soon catch a girl by the hair! Catch them around the neck and by the hind feet—I am talking about the sheep. Then go down the side to see whether the skin is thick. A healthy sheep is always a profitable sheep. I would not have a sheep with the foot rot in the barn. It is very easy to get rid of it. Put a trough of water so that he must run through it and dissolve in it blue vitriol and some lime. The sheep will run through this, and for another year you will not be troubled with foot rot.

Just a little later I will answer some questions, but I want to go back to what the sheep did for Woodland Farm. Last year we produced about 10,000 bushels of shelled corn, and about 300 tons of excellent alfalfa hay, and this year we will do better. My father's corn crop amounted to about 500 bushels, and perhaps fifty or sixty tons of hay, and the rest was pasture and undeveloped land. We have sold the crops from these sheep, and this year we have sold the sheep, and sold some crops and hay because we could not help it. We expect to feed them all just as soon as we can do it. I can fit them for 10 cents, and if I can do this it will pay me to feed them. I get my manure for nothing; it goes into the ground for corn, and what little is left goes on the pasture. Don't believe any man who tells you that manure hurts pasture. Our experience has been that it improves pasture a thousand per cent. It has not made it watery for us. In England they lime it, and put on basic slag. I know a man in South Kent who keeps thirty sheep to the acre, and that land has been used for many, many years, but he keeps fertilizing it; it keeps his sheep, and they fertilize it for him.

STARTING A FLOCK OF SHEEP.

By J. S. BURNS, *Imperial, Pa.*

In starting a flock of sheep, the prospective shepherd is presumably a young man without experience. And in such case we would advise a small beginning, because like every other line of farm opera-

ations, the greatest success is attained by growing up with the business. So a flock of 12 or 15 is large enough to experiment with. Now, some men of experience will tell you, it does not pay to bother with a flock of this size. But a wholesale venture without experience, is almost sure to result in disaster. Then he must outline his course. If he intends to produce thoroughbred animals to sell for breeding purposes, of course he must start with thoroughbred animals; and not only so, but with those of high individual merit; because farmers, and breeders, have become more discriminating, and only high-class animals bring first-class prices.

Then he must establish a reputation, not only for his stock, but for his own integrity and square dealing. And one discouraging feature on the part of a small beginner is, the public is likely to regard him with distrust, because of his lack of reputation. Also, in order to give his stock a reputation, and bring them forcibly to the notice of the public, he must make free use of printer's ink; and exhibit at a few of the leading fairs. We doubt if there has ever been a young breeder who has not had a keen ambition to appear with his stock, in the show ring. And it is the best piece of experience he can possibly have. For if he is a man of good sense, it will teach him, at least, two things—that there are others who have just as good, if not a little better stock than he has; and that he must accept defeat like "a little man," even though there be a little bit of injustice connected with it. It is by comparsion that we learn things of this kind, and by placing his stock side by side with that of others, furnishes a bit of education he cannot well afford to be without.

Now, the few things above mentioned, together with the first cost of suitable animals to begin with is expensive for a young farmer to start a flock of sheep, and I am not very enthusiastic about lending encouragement to a young man to start in the breeding of thoroughbreds. And I believe the foregoing is a very conservative setting forth of a few facts that should be duly considered, because beginners are sure to be infatuated with the seeming fabulous prices which experienced breeders sell their stock at, and think they can do likewise just as easy as not.

As to the best breed to start with—wool or mutton—would depend much upon the amount of range, and if he eventually intended to keep large numbers. If so, he would necessarily have to keep them in large flocks, and in this case the fine wools will best suit his wants, as they will do well in larger flocks than the mutton breeds.

meet the requirements quite as well as any. And if capital is limited, good grade ewes will produce just as good market lambs, by using a thoroughbred ram. But under no consideration use a grade ram for any breed.

And in starting a flock of mutton sheep the flock can be increased pretty rapidly by saving the ewe lambs each season, and marketing the ram lambs. But it will necessitate the buying of a new stock ram frequently to avoid inbreeding.

Located as I am near a good market, I cannot afford to raise my stock ewes, because I can get more for a lamb 3 months old, than I usually have to pay for a yearling ewe, by going where market conditions are less favorable, and thus save the keeping of the ewe lambs, with no profit from them but the fleece.

The best time to purchase the foundation stock for a flock of sheep, is an open question, and can only be determined by supply and demand. It is always a good time to start in any kind of stock when low in price, because an advance is sure to follow either sooner or later. But as a rule, about August is a time when more stock ewes are for sale than at any other time of the year. And this will give sufficient time to put the ewes in good flesh before being bred. And for a beginner, about October 10 is a good time to breed them. They will begin to drop their lambs about the first week in March, and if a comfortable stable has been provided no better time can be selected all things considered, because a good mutton ewe, well cared for will have an abundance of milk for her lamb from then until pasture time, and the lamb will learn to eat dry feed more rapidly before being turned to pasture. And the addition of pasture later will increase the flow of milk, and by continuing the feed, the lamb will grow very rapidly; and can be made ready for market at from $2\frac{1}{2}$ to 3 months of age, which is the most profitable time to market, because quick returns is what counts.

But on the other hand, if a good ewe is not allowed to drop her lamb until pasture time, care must be observed, or there may be a caked udder, and the ewe refuse to allow the lamb to nurse. Or, at least, there will be an over supply of milk to begin with, and acting on the same principle of a cow that is being milked by a careless milker—she will accommodate the flow to the amount consumed, and by the time the lamb is older and needs more nourishment it is not forthcoming.

CARE OF THE FLOCK.

Success with the incoming lambs depends much on the condition of the ewes. And it should be the aim to have them in high flesh, and maintain them so from breeding until lambing season. And if fall pasture is scarce, they should begin receiving about $\frac{1}{2}$ pound each, of corn and oats, increasing the amount as conditions may require until the beginning of winter when they should be maintained

During the winter the water supply should be carefully watched. It should be from a clean spring if possible, and so arranged that they can get it convenient. If they have to step in it with their front feet in order to drink, the chances are many of them will do without. A low trough is preferable if the flow is sufficient to prevent freezing.

Succulent food of some kind should be provided. Mangels are excellent, but rather expensive to grow. Turnips meet the requirements quite well, and are inexpensive to grow, as a catch crop, when sown among the corn at the last working. After the sheep become accustomed to them, they may be fed in almost any quantity the supply will admit. But usually a bushel to 25 ewes, once per day will answer, to aid digestion, and create a keen appetite for their food.

They should have a stable that can be made quite comfortable when necessary. But up until lambing time it is not advisable to keep them to warm. And at all times there should be good ventilation and free from dampness. There should be an abundance of room, and if possible, so arranged as to divide into two compartments, and increase or decrease the size of each. Then the ewes having lambs can be removed from the main flock. It is a great convenience to have a few hurdles made of light material with which to construct small pens in corners, where ewes having twins can be placed for a few days, until they are able to follow. When the lambing season is at hand they should be closely housed when cold, and when mild, not allowed outside of a yard connected with their stable. At this time the shepherd's vigilance is in demand, for a ewe that fails to raise at least one lamb curtails the profits. And a little attention at the proper time often saves a lamb. If one becomes chilled and unable to nurse, a sudden heating is almost sure to cause death. Use a piece of soft blanket, well warmed, and folded several times. Roll the lamb inside of it, leaving a breathing space. And if possible pour about a half ounce of warm milk into it. A bottle with rubber nipple attached is convenient for this. When this has been done, leave the lamb and its mother to themselves, and the chances are that in a half hour the lamb will be on its feet.

When the lambing season is over, the ewes may be again in one flock, and a portion of the shed partitioned off, with a creep provided for the lambs to go through. A trough should be here with a sprinkling of bran in it. This the lambs soon learn to lick. Then whole oats should be added. And if the ewes are not receiving plenty of succulent food, the lambs should have a small addition of oil meal. When turned to pasture, cracked corn, or whole wheat should be added, feeding all they will eat up clean twice per day. And so feeding and caring for them they will soon be ready for the butcher.

After all lambs have been dropped, the ewes should be clipped as soon as possible. We often clip in March, selecting a mild spell of weather. Then keep them from wet and cold winds, and in a few days a cold flurry does not effect them, and they thrive much better.

The wool will have a more glossy appearance than it will later, when they are being reduced in flesh from nursing their lambs. And it avoids being soiled from the lambs tramping over them while lying.

In conclusion, I must say, there are many acres of waste land in Pennsylvania being practically useless, where the natural conditions are ideal for sheep husbandry. The land is high and rolling, too much so for economical crop growing. Supplied with good water, and a natural growth of nutritious grass, which might well be utilized in this way, and thus add much to the yearly income of the land owners of the State.

BREEDING BEEF CATTLE.

By E. S. BAYARD, Pittsburgh, Pa.

There is no disguising the fact that for many years Eastern breeders of beef cattle have had a hard road to travel. When the free lands of the range territory and the cheap lands and cheap grain of the corn belt began to put cattle into market, the Eastern beef-maker was forced to turn his attention to something else, and with the beefmaker vanished to a large extent the breeder of beef cattle. Deprived of a market for his breeding cattle, for which he had previously found an outlet among the Eastern farmers, and unable to raise steers in competition with the ranges, he was in a bad fix to continue the business of breeding. It is true that the range and the West needed bulls, but it is equally true that breeders on cheaper lands nearer the seat of the demand, could and did supply them. Thus in all the territory east of the Ohio river, and in a good deal of it east of the Mississippi, beef herds were dispersed, vitiated with dairy blood, bred for dairy purposes, and otherwise lost to the beef business.

In recent years there is a slight tendency in the East to return to beef production. In the past fifteen years I have attended several meetings of this body, and this is the first time I have ever known beef to appear on the program. There are reasons for this. In the first place, the cost of producing beef in the West had advanced. Free grass is passing away, cheap corn is a thing of the past, and so is cheap labor. Taxes are higher in a comparatively new community, interest is higher, and in much of the territory engaged in beef production, lumber is higher than it is here. The cost to ship cattle is greater, and local markets do not exist as they do in the East. The beef producer of the East is not without certain advantages now; at least he may be called nearer equality with the Western producer, considering the value of his land, his taxes, interest and his markets. These things, as I said before, are mak-

in beef cattle here, is the difficulty of securing help to carry on the dairy business, the absolute need of cattle of some kind to consume roughage, the slight expense necessary for buildings and equipment, and the positive necessity of returning the products of the soil to the soil. Another influence is the utilization of all the corn crop by means of the silo and beef cattle. This is a great grass-growing State—and all flesh is grass. Beef is particularly a grass product, requiring comparatively little grain in its most economical production, as I shall show later.

I am not here to argue any man into dropping the dairy business for the beef business. Neither do I believe trying to combine the two. A successful dairyman needs a dairy herd and a dairy equipment, and he must work both to their full capacity to make a success of his business. If a man is going to be a dairyman, let him be a real dairyman and keep out of the beef business. I have never seen a successful beef dairyman who would not have been more successful if he had been a straight-out dairyman. But the dairy cow does not suit every one. Some men who can be, and are, good beef cattle-men, can never understand a dairy cow—can't see her right. Others are too short of labor, and cannot attend to dairy cows themselves. Others lack the buildings and equipment necessary to run a dairy properly, and especially those who have or can obtain these cheap farms we hear so much about, farms not usually well equipped with buildings. To all such men I commend the beef business—raising beef cattle or feeding them—as a way to greater fertility, and ultimately to profit. For I have faith in our markets for beef and faith in any territory as a beef-raising territory, which can grow grass. More and more our grass must be depended on to make our beef, and a State which grows grass will again produce beef to some extent.

While it may have been the idea of those who assigned me this topic to confine this discussion of the breeding of pure-bred beef cattle, I do not think this is the proper thing to do. Breeding pure-bred beef cattle must develop as the raising of cattle develops, to a certain extent. This subject is so vast that it must outrun any reasonable bounds if I attempt to discuss it in full, and so I shall merely outline it here and trust that you will resort to questions to bring out such points as you may wish to know more about.

THE MAN AND THE BUSINESS.

The first requisite of a successful beef-breeding establishment in the East is a man who is determined to stick to the business and make it successful. The second is grass and water. The third is fences. The fourth is inexpensive buildings. The fifth is a set of scales. The sixth is cattle.

The two great branches of the beef industry worthy of attention in the East are: Breeding or raising beef for market; feeding or finishing cattle for market.

The man who expects to make a business of raising beef cattle in the East will find some decided advantages, as well as a few disadvantages in a herd of pure breeds. The main disadvantage is the first cost, which is likely to be about one hundred per cent. greater in the case of pure-bred animals. The chief advantages are:

- (1). Better cattle than grades.
- (2). Uniformity.

- (3). Better market for surplus females.
- (4). More interest and pride in the business.
- (5). Show steers.
- (6). Occasional bull sales.

THE BREED.

Suppose a man decides to enter the ranks of beef-raisers, and to start in a modest way with pure bred animals. What breed shall he choose? It depends on what he is going to do with his cattle, and the kind of country he is in. If he expects to grow them on roughage and to keep them until they get some age before finishing, there is nothing better than the Shorthorn, because it will continue to make growth and pounds. If he wants to mature or ripen his cattle early, he should choose the Angus or the Hereford, which will fatten at an early age better than the Shorthorn. If he has sparse pastures and steep, the Devon may be useful if the oldtime beefy strain of Devons can be found. The Shorthorn, the Angus and the Hereford, have one great advantage over any other breed in this territory, and that is the ability to secure sires to maintain and improve the herd near at hand. For this reason I would suggest that one of these breeds be chosen rather than a breed comparatively rare in this territory. If any breeder or cattle-raiser near by has the breed adapted to your purpose, choose it, for there are advantages in doing so, too obvious to mention.

HERD FOUNDATION.

In choosing the foundation for a herd, get the required type in mind, and then get individuals that represent that type. I do not believe in going to any extreme in fashion of pedigree, color, form or size. The medium ground is safest and best for the man who wants to produce good beef cattle. Fashions are costly and transitory. The *family* fashion, which restricts choice to the descendants of certain female lines, is particularly foolish for any man to adopt who does not intend to breed cattle to head pure-bred herds. It is a commercial necessity for some of these, but it is a false foundation and any structure reared on it alone will ultimately fall to the ground. Learn what beef merit is and buy cattle that have it and whose ancestors had it. Then you are pretty sure to get it.

THE COWS.

The basis of a herd of profitable cattle is the cow. The best and cheapest way to buy a herd is to select young cows with calf at foot and in calf again or bred again. Younger animals, yearling heifers particularly, are more attractive to the eye, and have one advantage—they are guaranteed to breed. A cow with calf at side has no such guaranty further than the calf, and at the buyer's risk, but this risk is very slight.

DESCRIPTION OF COWS.

In selecting a cow herd lean to the roomy type, but avoid coarseness, especially projecting hook bones, long flat ribs, high tail-heads, coarse heads and long legs. Above all, avoid the steery cow. The rule of all nature holds good in selecting the matrons for a beef

herd. Don't get a masculine or steery type of cow; get a cow of pronounced femininity. There are several good reasons for this, but the first and greatest of all is that these cows are the best mothers. Look over the cattle you know, regardless of breed, and you will always find that the feminine type of female will produce the most masculine type of male and the most feminine type of female. And this is important to any breeder of any class of animals, for buyers of intelligence want masculine bulls and feminine heifers. There is one other important reason for choosing a feminine type, and that is, unless you do not choose this kind, your cows will lack milk, will not arise their calves properly, and are likely to cease to breed and go fat to the market just when they should be in their prime.

The milking properties of the beef breeds have been grossly misrepresented, yet, as in all such cases, there is some foundation for the false idea that exists. A beef cow that will not raise her calf well is of little use to any breeder, and beef breeders must of necessity consider milk, and always do.

EASY FLESHING.

This is a term often misunderstood. Most people think that this quality in a beef animal means merely ability to put on flesh quickly and at little expense. "Get fat on nothing," is what we often hear. There are two classes of easy-fleshing animals in the beef breeds. One class consists of those steery cows that always carry flesh, and these are to be avoided. The other class consists of cows which milk well, lose flesh quickly while milking, and pile it on rapidly and economically when dry. As a rule among beef cattle, the cows which take off their flesh most rapidly put it on again most quickly. These are the real easy-fleshing cattle, the kind to get and stay with.

THE BULL.

For exactly the same reason as given for selecting feminine cows, choose the masculine bull. Get some size, or the promise of it, in buying a bull. Bone enough, loose hide, "stretchy" but not too thin, good hair, not coarse, but abundant in season when needed. Get a bull with what might be called an honest countenance; not long-nosed, narrow between the eyes. Pick for correct lines—straight—thick or broad any way you look at him. Eyes placid and not deep set. Hocks not too straight or too crooked. Loin strong. Twist well developed. Forelegs well apart when in flesh.

should be handled according to it. I have seen some wonderful plans for handling bulls. In some the bull is kept in a high walled prison and prodded to and from his duty. In others he is strung on a trolley car by a ring in his nose. No such course should be taken in handling a beef-bred bull. I consider the ideal plan to have a blue grass pasture well fenced, with a small barn or shed in one corner and a small yard, of which it may be part of one side. Give the bull a companion—cow or steer—and he will rarely become ugly, can be handled with ease and safety, and his abundant exercise and quiet mind must surely tell on succeeding generations.

FEEDING THE BULL.

A well-bred beef bull will do good work and keep in fair condition on grass alone; but he should have some grain to develop him properly unless the grass is very good. There is such a great difference in individual bulls, in their temperament, fleshing, etc., that no rules for feeding can be given. As a general thing, a beef-bred bull can stand more corn feeding than is usually prescribed. Corn and oats are about as good a combination as can be found for a service bull. Any feed that keeps him thrifty is all right, and the cheapest is the best, as long as it does this.

FEEDING THE COWS.

The feed for cows will vary according to what they are doing. Dry cows can be kept very nicely on clover hay alone, will take on flesh and raise good calves if wintered on it only. In summer dry cows nursing cows too need only good grass. Cows nursing calves in winter should have grain in addition to their hay. Silage and clover hay if liberally fed, ought to make them and their calves prosper. I usually feed hay and a little corn or corn-and-cob meal and oil meal to nursing cows, but the grain ration is not heavy. The profitable way of keeping cattle is not always the ideal way. If we are to make anything out of beef cattle in the East, they must not be kept in showy condition, but in working condition. Mumford found by experiments that 18 pounds silage and 4 pounds clover hay, with access to straw stack, caused dry cows to gain 1 to $1\frac{1}{2}$ pounds per day. Or 10 pounds of shock corn and 4 pounds clover hay and straw *ad libitum* wintered them well. These amounts per 1,000 pounds weight of cow. Cows can be wintered on less than these rations, but they will not milk so well after calving as when fed better; and milk makes calves.

CATTLE BARNS.

Cattle barns, as dairymen understand them, are not necessary for beef cattle. The best beef cattle barn is a shed or barn free from drafts, into which they can go at will. It may be that cows with very young calves will prosper better in a warm barn when the weather is severe, but these too will soon be better in the shed. It should be tight above, and free from cracks or draughts. Leave it open on the side from which winds do not come—or build a straw stack across the entrance a little distance away, or use any plan to keep it open and yet not windy. Beef cattle care little for cold. I do not believe any breeder can afford to house his cattle all the time. A dairyman may do it with profit if he is constantly buying, forcing and selling cows. No breeder can afford it.

WATER.

The best water for cattle is that which comes directly out of the ground, is not chilled by standing in a trough where ice can form. A spring is best. Cattle like a little mud in their water and do best when they have it. All cattlemen and especially those who keep their cattle in warm quarters and under high pressure, should give them a bit of fresh dirt now and then. The most successful dairy feeder I ever knew did this, and I find that many older cattlemen have practiced it with good results. Cut a piece of sod, and give them a bite of it.

THE CALVES.

The spring calf has some great advantages to the man who wants to make beef of him economically. He can be put on the market as a feeder or as beef when a long yearling, and most of his weight made from grass, as he sees only one winter. The cost of keep must govern the method of growing beef. It is a possibility with the early-maturing breeds to make an occasional steer weigh 1,000 pounds at twelve months and have him ripe enough for any trade. This is baby beef in the quickest time, but it may not be the most economical, because it requires too much expensive feed. It may be better to use more grass and less grain and have them go to market at eighteen months at 900 to 1,000 pounds. One distinct advantage of the Eastern beef-maker is that he can usually dispose of one to ten steers near home, and can send them off whenever he gets them ready. A long yearling steer should fetch \$5 to \$6 per cwt., if he is ripe enough, and that means \$50 to \$60, which ought to pay him for his grass, for his grain, and the economical keep of his dam, which is in the meantime producing his successor. Feeding all this stuff on the farm and buying a little every year will make it more productive.

FEEDING CATTLE.

The man who buys cattle to feed has a big problem ahead of him. Good feeders are hard to buy, costing at present \$5 to \$6 per cwt. But it is sometimes more profitable to buy them than to breed them. The winter feeding proposition usually involves too much plowing for the growing grain, and too much labor to make it highly profitable in the East. I believe that as a rule it will pay the Eastern beefmaker better to merely winter his steers and to finish them on grass. And here is an important point—when steers are to be finished on grass, do not winter them too well. Have them thrifty but not fleshy when they go on grass. Otherwise they are likely to do no good, and even lose flesh, and often so much of it that they are no better by July 1st than when turned out, if as good. If grain can be fed on grass this may not apply, but it is a question whether it pays to feed grain in the early part of the season. Not a few experiments have been made which go to show that grain feeding on grass does not pay, but by my experience has been that it does pay toward the finish. A little grain on good grass goes a great ways toward ripening a steer.

KIND OF STEERS TO FEED.

The kind of steers to feed cannot be described here because of lack of time, but the class may be touched on briefly.

First, calves bought from the ranges. These require a long feed, usually one whole winter and one summer and a part of next winter to make them prime. Ordinary range-bred calves cost \$15 to \$25 per head and when ripe sell at \$40 to \$70 per head, according to their quality and finish.

LONG YEARLINGS OR TWOS.

A great variety of methods of handling these. Buying in fall, roughing through winter, finishing on pasture alone, is one method. A gain of about 300 pounds is about what may be expected with good steers well kept in this style, and an advance of \$1 to \$1.50 per cwt. on the original purchase price. Another common method is to buy feeding steers and finish with grain, not usually a profitable business here, where grain is so costly. Another method is to buy steers in good flesh and finish by a short feed. This is a ripening process, for which Eastern markets do not pay proper reward, as a rule.

QUALITY OF STEERS.

Remember that the feeder can sometimes make most money off the plainest steers because they are the cheapest. The cattle raiser always loses here, but the feeder can sometimes profit by his mistake. Plain cattle make more improvement in class than better ones do—a fat steer usually goes up a notch in classification over his feeder class. Remember, also, that a cheap steer requires a larger feeding margin than a dear one. A 1,000 pound steer costing \$4 per cwt., gaining 300 pounds, and selling for \$5, shows a margin of \$25. A 1,000 pound steer costing \$5, and gaining 300 pounds, selling at \$6, same advance as the other, shows a margin of \$28. He usually requires less feed to put him where he will fetch the \$1 advance on original weight.

THE INDIGESTIBLE PART OF THE RATION OF THE DAIRY COW.

By PROF. WELLS W. COOKE, Washington, D. C.

Speakers and writers on the subject of the feeding of the dairy cow are accustomed to devote most of their attention to the digestible part of the ration. Since it is only the part digested that is of any use to the animal as a source of material for the production of meat, milk or butter, it is natural that this part of the ration should be given the most prominence. Nevertheless, when a closer study is made of the subject, it will be found that the furnishing of a proper amount of indigestible material is an important matter in profitable dairying, and that the best feeders are very careful in practice to treat the cow properly in this regard, though they would not be able to state explicitly in pounds per head per day, the needs of their animals.

Two examples will make this point clear. Twenty-five pounds of bran contain all the digestible material needed by a thousand pound cow for a day's ration, and these digestible materials are in good

proportion, yet no dairyman would think of feeding his cow nothing but bran, even though bran was the cheapest feed on the market. He would say that such ration was too concentrated; that the large first stomach, or paunch, of the cow, that nature expected her to consume large quantities of coarse, bulky fodder. On the other hand thirty-five pounds of good clover hay also contain the digestible nutrients for a day's feed, yet the dairyman would not expect a good cow, in full flow of milk to do her best on a ration of nothing but clover hay. He would say the ration was too bulky; that in spite of her large paunch, the cow could not eat enough clover hay per day to do her best. It will be noticed that in each of these rations, the trouble is in the indigestible part. Each contains the proper amount and kind of the digestible nutrients, but the first does not contain enough indigestible material to keep the animal in health, while the second contains too much indigestible matter for the cow to do her best. The purpose of the present discussion is to find the happy medium between these two extremes.

Many years ago, German experimentors announced that a dairy cow weighing a thousand pounds, required in her daily ration 2.5 pounds of digestible protein, 0.4 pounds of digestible fat, and 12.5 pounds of digestible carbo-hydrates, giving a nutritive ratio of 1:5.4 This is commonly called the German standard ration for the dairy cow. Much effort has been expended in this country to prove that this German standard is higher than necessary in digestible protein, and it has been shown that under some conditions a cow will do well with a smaller portion, yet it is remarkable how close an agreement with this standard will be found in the rations of the best feeders in the Eastern United States. This agreement is especially close in the case of dairymen furnishing milk for the retail trade of cities. These dairymen are, as a rule, milking a good grade of cows, and are feeding them heavily on the highest priced materials, and yet without figuring on chemical constituents, experience has taught them that they get the most return for the money expended when they use fodders so rich in protein that the ration comes up fully to the German standard. It is known now that no one standard will do for all cows, but that the quantities of feed have to be varied according to the amount of milk produced—the larger the milk flow, the larger the ration. Later investigations have also shown that the proportions of digestible protein needs also to be varied—the larger the milk production, the larger the absolute and relative amount of digestible protein, i. e., a cow giving a large flow of milk requires a narrower nutritive ratio than one yielding a small amount.

For the first part of the discussion, we will use the original German standard, which is not far out of the way for a thousand pound cow, yielding twenty pounds of milk daily, and later note how the ration should be modified as the amount of milk varies.

Clover hay has long been known as a first-class milk producing food, and 35 pounds of it contain 2.4 pound of digestible protein and 13.9 pounds of digestible carbo-hydrates, or a total of 16.3 pounds digestible, while the standard mentioned above calls for 2.5 pounds of digestible protein and 13.4 pounds of digestible carbo-hydrates after reducing the .04 pounds of digestible fat to its equivalent in carbo-hydrates or a total of 15.9 pounds digestible. So far,

then, as the digestible part is concerned, the clover shows a close agreement with the standard, and if it was to be judged by the digestible alone, it would be called a good feed to be used by itself. Every dairyman knows that such a conclusion is wrong, and the error arises from considering the digestible part, without also taking into consideration the indigestible matter with which it is combined. The German standard calls for twenty-four pounds of total organic matter in the daily ration for the dairy cow, while some other proposed standards call for the same amount of total dry matter, and still others call for a slightly larger amount. The average practice of the best dairymen in the Eastern United States seems to be feed such an amount of coarse fodder that the whole ration will contain about 4 pounds of "crude fiber," which is in the indigestible part of the carbohydrates. This "crude fiber" of the chemist is principally the woody fiber of the plant, and its presence in greater or less extent constitutes the principal difference between the so-called coarse fodders and the concentrated grains. A hundred pounds of wheat straw contain about 38 pounds of this fiber, while the same weight of the grain of wheat contains less than two pounds. These two pounds of fiber are in the outer, brownish covering of the wheat, and in the process of milling go into the bran, leaving the flour free from fiber. Thus the various straws stand at one extreme as those richest in fiber, while the concentrated grains contain the least percentage of that material.

Returning now to the clover ration for the dairy cow, the 35 pounds of clover hay contain on the average 8.8 pounds of fiber, while the standard calls for only four pounds. These extra 4.8 pounds of fiber furnish the real reason why the clover hay is not a satisfactory feed to furnish the whole of the ration for the dairy cow.

The fiber in the food, i. e., the digestible part, is what makes the food difficult to chew up and digest. The amount of labor performed by a dairy cow in grinding up and digesting her food is little realized by most dairyman. The time spent by the dairyman himself at the table is considered recreation instead of labor, but if he found on his plate a handful of cornmeal and a little pile of chopped hay, he would not have to chew long on these materials to realize that the eating of such food is real hard work. But it is just as much work for the cow to chew the corn and hay as it would be for her owner. A man takes a ton of corn to the mill and gets it ground for a small sum. If he returned the next day with a ton of hay and asked to have it ground, he would be charged more than the value of the hay. It actually takes as much force to grind one pound of hay as twelve pounds of corn.

A horse plowing ten hours a day is thought to be doing a full day's work. A good horse will be able to do this work and keep up in flesh on about twelve pounds of oats and fifteen pounds of hay. He is supposed to be working ten hours a day, but in reality he is working fourteen hours a day, since the chewing and digesting of the twelve pounds of oats and the fifteen pounds of hay uses up as much muscular energy as is required by four hours of hard plowing. Many people have claimed that the dairy cow must not be kept in the barn day after day, but must be let out so that she can get exercise. A good dairy cow in full flow of milk is always getting

plenty of exercise. Even the most ardent advocate of exercise would admit that four hours daily of plowing would furnish a sufficiency of muscular exertion. But the cow is getting at least this much from the chewing and digesting of her food, when she is otherwise staying quietly in the barn.

It is the fibre in the food that necessitates the exertion of most of the force required in mastication and digestion. In the light of the foregoing remarks, we can now see why the extra 4.8 pounds of fibre in the clover decreases its value as a dairy feed. All of the force expended in the chewing and digesting of the food must come from the part of the food that is digested and assimilated. None of the force so used can serve for the production of flesh, milk, or butter. Therefore, from the store of nourishment derived from the digested food, the cow has to take out first enough to supply warmth to keep up the heat of the body; next, enough of all kinds of material to repair the worn-out tissues and fluids of the body; then, enough force to do the work of the body, including the chewing and digesting of the food. If after all this is accomplished, there is still a surplus, this remainder can be used for production of flesh or milk. It is evident that every pound addition of the fibre decreases the net amount of digestible food available for production. The indigestible part of the food cannot be used for production of any kind, and its only use to the cow is to make bulk in the ration and distend the paunch, so that this organ may work properly in returning the food to the mouth for rechewing.

The problem before the feeder is, therefore, not to see how much fodder he can get his cows to eat, but how little they can consume and still keep up in health and have the paunch perform its proper functions.

Just how much labor is required to chew up and digest each pound of fibre has not yet been settled definitely. It is known that the amount is large and that it is well toward the food value of a pound of digestible material from the remainder of the ration. There will probably be no serious error if it is taken as the latter amount, i. e., that each pound of crude fibre in the ration uses up the value of one pound of the digestible material available for the production of milk. It is probable that this statement is a little too strong, and the above proportion will be used with the understanding that the resulting net food values obtained are probably a little lower than the truth.

Returning now to the clover ration for the dairy cow, the 35 pounds of clover contain 16.3 pounds of digestible material and 8.8 pounds of fibre. If the presence of each pound of fibre destroys the value of one pound of digestible material, then the 8.8 pounds subtracted from the 16.3 pounds, leaves only 7.5 pounds net of digestible material available for milk production and the needs of the animal body. The standard ration calls for 15.9 pounds of digestible, combined with only 4 pounds of fibre, or a net available of 11.9 pounds of digestible. Thus although the 35 pounds of clover hay has a slightly larger amount of digestible material than called for by the standard ration (16.3 pounds as compared with 15.9 pounds) yet so much of the value has to be used for chewing and

digesting the fibre that the resulting net digestible is less than two-thirds the requirements of the animal, and, of course, under these conditions, the animal cannot do its best.

Dairymen have come to realize that timothy hay, as ordinarily made in Pennsylvania, is a pretty poor milk producer. A knowledge of its fibre compositions shows one of the reasons for this result. About 30 pounds of timothy hay per day is the most that a cow could eat and these 30 pounds would contain .08 pounds of digestible protein and 13.9 pounds of digestible carbohydrates or a total of 14.7 pounds digestible, which is not seriously below the 15.9 pounds digestible of the standard ration. But when the 8.5 pounds of fibre are subtracted from this 14.7 pounds digestible, there remain only 6.2 pounds net digestible as compared with the 11.9 digestible of the standard. So then a cow that has eaten all the timothy hay her paunch will hold has taken into her system only one-third as much protein as she needs, and only half the necessary total nourishment for full milk production. Corn stover shows closely agreeing figures. A cow can consume about 40 pounds daily, and these 40 pounds contain 0.7 pounds of digestible protein and 13.6 pounds digestible carbohydrates or a total of 14.3 pounds digestible, from which is to be subtracted 8.0 pounds of fibre, leaving only 6.3 pounds net digestible. The fibre content is the most striking difference between a dry corn fodder and silage. A hundred pounds of good silage contain .09 pounds digestible protein and 12.9 pounds digestible carbohydrates; a total of 13.8 pounds digestible. If the comparison stopped here, the dry fodder would seem superior to the silage, but when the fibre is taken into consideration, the conditions are reversed. The 100 pounds of silage contain only 4.9 pounds of fibre as against the 8.0 pounds in the dry fodder, leaving a net of 8.9 pounds digestible, almost a half more than in the dry fodder. Moreover, just here comes in another principle, which is best illustrated by pasture grass. All dairymen are agreed that if a cow has good pasturage she will produce a good flow of milk without addition of grain. It has been found that a cow will eat about 80 pounds daily of pasture grass, which will supply her system with 2.3 pounds digestible protein, 13.1 pounds digestible carbohydrates or a total of 15.4 pounds digestible. This is combined with 4.3 pounds of fibre, leaving a net digestible of 11.1 pounds. As compared with the standard, this ration of 80 pounds of pasture grass is a little low in protein low in carbohydrates, more than the standard in fibre, and less total net digestible food, and yet experience has shown that the cow will make a larger milk production on this apparently scant ration of pasture grass

ago, when studying the relative feeding value of dry corn fodder and silage, I found it to be a fact that the pound digestible in the silage produced more milk than a pound digestible in the dry fodder. At that time I could give no satisfactory explanation, but since the experiments were conducted on the work of mastication, the reason is evident.

So far we have given the analyses of coarse fodder with reference to their content of fibre. Now let us contrast this with some of the commonly used grains. Twenty-five pounds of bran contain 3.1 pounds digestible protein and 11.3 pounds digestible carbohydrates, a total of 14.4 pounds digestible—a little less than the standard. But these 25 pounds of bran contain only 2.2 pounds of fibre, leaving a net digestible of 12.2 pounds—a little above the standard. The 25 pounds of bran contain just about the right kind and amount of digestible material for a day's ration of a dairy cow, but the fibre is only half as much as the standard, i. e., a ration of bran alone would be seriously lacking in bulk—it is too concentrated to be fed alone. The analysis of corn shows how utterly unsuited this grain is to serve as the sole food of a dairy cow. A full day's ration of twenty-five pounds contains only 2.0 pounds of digestible protein—less than the needs of the cow—combined with 19.1 pounds of digestible carbohydrates—a half more than the standard—and only 0.6 pounds of fibre an amount so small that the animal fed on corn alone could never ruminate. Cottonseed meal is equally one-sided; an equivalent quantity—25 pounds—contains 9.3 pounds of digestible protein—more than three times the needed amount—11.1 pounds digestible carbohydrates—less than the standard—combined with only 0.8 pounds of fibre—a fifth as much as the cow needs to do her best. A mixture of cornmeal and cottonseed meal could be made that would be just right so far as the protein and the carbohydrates are concerned, but such a mixture would always be lacking fibre to give it the necessary bulk.

There is a so-called "concentrated food" on the market at the present time whose analysis shows that it is not entitled to the designation. This is alfalfa meal, or ground alfalfa hay. It is sold for more than twenty dollars a ton, and the claim is made that it is equal in feeding value to bran. If the fibre is disregarded, this claim would seem to be justified. The alfalfa contains, in 100 pounds, 11.0 pounds digestible protein and 42.3 pounds digestible carbohydrates, or 53 pounds total digestible, while an equal weight of bran contains 12.2 pounds digestible protein, 45.3 pounds digestible carbohydrates—a total of 57 pounds digestible. If we stop here, the alfalfa seems almost equal to the bran, but when the fibre is taken into consideration, a very different complexion is given to the analysis. The 100 pounds of bran contains only 8 pounds of fibre, which subtracted from the 57 pounds of total digestible, leaves 49 pounds net digestible for milk production, while the 100 pounds of alfalfa contain 24 pounds of fibre, which taken from the 53 pounds of total digestible leaves only 29 pounds net digestible. In other words, bran at \$40 a ton would be just as cheap as alfalfa meal at \$24. Or, if bran can be purchased at \$24 a ton, the alfalfa meal would have to sell for less than \$15 to be as cheap.

The foregoing statements make it plain that the principal reason why grain is fed to dairy cows is for the purpose of reducing the amount of fibre in the ration. The standard ration calls for about 16 pounds of digestible material and 4 pounds of fibre. Materials that contain a larger proportion of fibre are called coarse fodders and those with a smaller content are known as concentrated feeds. The standard ration contains 25 pounds of fibre for each 100 pounds digestible and the following table shows the relative amounts in some of the common dairy foods:

	Total digestible pounds.	Fibre pounds.
Standard ration,	100	25
Oat straw,	100	25
Timothy hay,	100	58
Corn stover,	100	56
Clover hay,	100	54
Alfalfa hay,	100	44
Silage,	100	43
Pasture grass,	100	28
Bran,	100	15
Oats,	100	14
Cottonseed meal,	100	7
Corn,	100	8

The problem of the feeder is to make such a mixture of materials, rich and poor in fibre, that the resulting ration, while containing the proper kind and amount of digestible ingredients, shall also contain one-fourth as much fibre.

Since the coarse fodders raised on the farm have an excess of fibre and are low in digestible protein, and since grain is bought for the purpose of obtaining the needed protein, and because it is low in fibre, it follows that in buying grain it is the part of wisdom to buy those grains that are lowest in fibre and highest in protein; fewer pounds will have to be bought to balance the coarse fodders raised on the farm. Just here is the strong argument against the "molasses feeds" now on the market. In general these are composed of a mixture of some concentrated grain, like linseed meal, and some waste product, like oat hulls, with enough of low grade molasses to make the mixture palatable. The molasses in itself is a good feed, but it has no more value than an equal weight of cornmeal and is lacking in protein. The presence of the oat hulls or other refuse makes the mixture high in fibre so that the molasses feed fails to satisfy each of the purposes for which a grain is purchased.

A common practice among dairymen needs here to be mentioned; many farmers feed liberally of grain and good coarse fodders morning and evening, and then at noon throw into the manger a forkful of oat straw or some other hard, woody substance. They think the more they can get the cow to eat of such material, the more the profit. Oat straw is fairly well digested by the cow, but look at its content of fibre. When the cow has labored vigorously for half a month, and has succeeded in worrying down 100 pounds of oat straw, what has she gained? The 100 pounds of oat straw contain

42 pounds total digestible, but they also contain 37 pounds of fibre that has to be chewed, digested and gotten rid of, using up all but five pounds of the food value obtained from the digestible part. So the dairymen has been asking his cow to do a large amount of extra work, for which she can return little or nothing in extra milk flow. It is the same principle as if he drove her a couple of miles each day along the highway for the sake of the few mouthfuls of grass she might snatch from the roadside. Instead of taking this extra amount of fibre into the system, it would be better to allow the cow to rest and ruminate through the middle of the day, and put her energies night and morning into the chewing and digesting of material rich in net food value.

The standard ration used in the previous discussion, furnishes 25 pounds digestible protein, 13.4 pounds digestible carbohydrates and 4 pounds of fibre, contained in about 24 pounds of total dry matter. This is a fair ration for a 1,000 pound cow, yielding about 20 pounds of milk daily. Some late investigators have undertaken to vary the standard according to the quantity of milk produced. The best known are the standards of Dr. Kahmann, which are given below:

Daily Ration for a Milk Cow When Yielding Daily.	Total dry matter. Pounds.	Digestible protein. Pounds.	Digestible carbohy- drates. Pounds.	Total digestible. Pounds.
11.0 lbs. milk, -----	25	1.6	10.7	12.8
16.6 lbs. milk, -----	27	2.0	12.0	14.0
22.0 lbs. milk, -----	29	2.5	13.2	15.7
27.5 lbs. milk, -----	32	3.3	14.9	18.2

It will be noted that all the different ingredients of the ration increase as the amount of milk produced increases, but the increase is in very different proportions. As the protein doubles, the carbohydrates increase less than a half and the total dry matter adds less than a third. It will be seen that the increase in digestible material amounts for nearly all of the increase in dry matter, or in other words, this experimenter believes that the cow giving a small flow of milk requires the full four pounds of fibre per day to distend her paunch, and that this amount should not be increased, no matter how heavily the cow is fed. This means that in heavy feeding, the extra feed should consist almost entirely of concentrated grain. The above remarks apply to cows of 1,000 pounds weight. If the cow is larger, the amount of fibre per day should be proportionately increased, and it should be correspondingly diminished for the smaller cow. The 1,500 pound cow would receive 6 pounds of fibre per day and the 750 pound cow only 3 pounds.

The conclusion of the whole matter is that the successful dairyman will strive to have the ration of his cow as concentrated as possible, consistent with their health.

HORSE BREEDING FOR PENNSYLVANIA FARMERS.

By PROF. THOS. I. MAIRS, *State College, Pa.*

The object of these talks, as I understand it, is to exchange ideas and present to each other what we believe should be presented to the farmers of the State. With this idea in mind I say what I do concerning the production of horses in Pennsylvania.

The horse is an animal of universal interest, one which cannot be dispensed with by persons in any class of agriculture. The stockman, the dairyman, the trucker, and the gardener as well as the general farmer all have uses for horses. Moreover, the horse is not only used on all farms, but large numbers are used in the cities which must be produced on the farms. There has been, within the last few years particularly, a rather spirited discussion as to whether we are coming to a horseless age. I do not propose to take part in this discussion so far as the future is concerned, but I believe it can be clearly shown that up to the present time, if we are approaching a horseless age, our progress has been decidedly slow. There is no doubt that the growth of the motor car business has been remarkable in the last five or six years, but the best statistics available indicate that the horse has not suffered appreciably from it. In 1903 there were in the United States approximately 16,000,000 horses, valued at \$62 per head, in 1908 there were 20,000,000, valued at \$93 per head, an increase of 2 per cent. in numbers and 50 per cent. in value. In Pennsylvania in 1903 there were 678,000 horses valued at \$81 per head. In 1908 607,000, valued at \$114 per head, again a decided increase in valuation and a slight increase in numbers. These figures, I believe, show conclusively that the horseless age is yet some years in the future. It is only in a few instances as in some delivery wagons, trucks, etc., that the horse has been displaced by the motor. In most cases those who keep motor cars either keep them in addition to the horses which they formerly kept or would not keep horses even if the automobile were not available. A large majority of the horses kept in Pennsylvania are produced outside the state. There were in Pennsylvania, according to the census of 1900, 30,619 horses and mules under one year old and 976,119 over two years' old. If we assume the average period of usefulness to be ten years, which would mean that the average age of a horse at the time of its death was twelve years, we find that only about one-fourth enough colts are raised to supply the demand for horses and mules in the state. Our contention is that the Pennsylvania farmers can produce their own horses cheaper than they can buy them and not only can they produce horses for their own use, but can produce at a profit a surplus for the cities. It is impossible to get records of all animals shipped into Pennsylvania, but the receipts of horses at Philadelphia in 1908 were 15,198, the shipments 8,546. Showing that if this is to be taken as an average year that Philadelphia uses up each year 6,652 horses. This is as-

suming that none of the horses shipped out were broken down horses taken to the farm. Allentown, which is undoubtedly an agricultural community, received 4,500 horses and shipped out 2,600, leaving 1,900 horses bought in that immediate neighborhood for use in that year.

Most of the horses shipped into Pennsylvania come from west of the Missouri River. Some are produced in Missouri, Illinois and Iowa, but the majority probably are bred farther west and are brought to Missouri, Iowa and Illinois as two or three year olds, are kept there a year or two, broken, fattened, sent to the East St. Louis or Chicago market and then come further east as Illinois or Indiana horses. There is no reason why they should be called Illinois or Indiana horses rather than Montana or Wyoming horses, further than the prejudice against the cayuse or broncho. In fact the probabilities are that the horses coming from west of the Missouri River are actually better than those coming from east of the Mississippi River. They have been graded up from the broncho stock by the use of stallions of the draft breeds. They have been subjected to more harsh treatment, the weaker ones have been dropped by the wayside and only the stronger survived. Furthermore the soil and climatic conditions have been such as to develop toughness of foot, hardness of bone and hardiness of constitution.

We believe that Pennsylvania has the soil, climate and water for producing better horses than can be produced in the prairies of the West. We believe that naturally the Pennsylvania horses have better feet and legs and are more able to stand the pounding on the hard roads and the climbing of hills than are western horses. Further, it is well-known that a western horse shipped into Pennsylvania is of very little use for six months to a year after shipment. It is true that some shippers use a serum which it is claimed renders the horses immune from acclimatization fever, but the general opinion among farmers and others is that a considerable period of uselessness results in any case.

The western horses shipped into this State four, five or six years old sell anywhere from \$200 to \$250. Our contention is that our farmers can raise as good or better horses for less money. The horse on the farm ought to be able to pay for his keep after he is two years old. His dam will more than pay the way of herself and foal during the suckling period, so that there should be charged against the horse only the service fee, cost of keeping until he is two years old, plus a certain amount for insurance and risk.

The Pennsylvania farmer can well do most of his farm work with brood mares. It will do them no injury if carefully handled and he will be able to get practically as much service from them as from geldings or from mares that are not used for breeding purposes. It costs little if any more to raise a colt than it does to raise a calf. As a two-year old, one is worth twice as much as the other. One hundred dollars ought to be ample to bring the colt to two years of age and show a profit after which time he should be self-sustaining. This applies to animals or colts used for farm or draft purposes rather than those that are used for pleasure.

We do not believe it wise to encourage the average farmer to engage in the production of pleasure horses as a business. This would better be left to specialists and to wealthy men who can afford to charge up part of the cost to recreation.

As to the breed which the farmer should select, I would say select whatever one he can sell best in his neighborhood and to which his farm and methods of farming are adapted. All of the draft breeds have their advocates and undoubtedly all have their good qualities. For the average grain farm or comparatively level land some breed of this type would be best. In some cases on rough farms coach horses and horses of a general purpose type would be better. One disadvantage here is that if marketable animals are not obtained, those left on the farmer's hands are of much less use than if they were more nearly of the draft type. Whatever breed is selected he should stick to that one, but especially should he stick to that type or class. The man who attempts to get the good qualities of two or more breeds and eliminate the bad ones by crossing is almost sure to do exactly the opposite. The reason is very simple: the good qualities are more artificial and have been secured by careful and rigid selection, the bad ones are more common and have generally been inherited from a longer line of ancestry. Since crossing tends toward variation and since variation tends toward the mean of the race there is produced those average qualities which do not fit the animal for any particular purpose. This is exhibited most strongly when cross bred animals are used for breeding purposes.

The first thing which the farmer and future horse breeder must select is his brood mares. These should be selected primarily from the standpoint of their being able to do the work required of them. It would be a mistake to select heavy draft mares for some of the rough hill or mountain farms and a greater mistake to try to do the work on comparatively level farms with light mares. Horse power is cheaper than man power.

Maternity rather than beauty should also be kept in view. The best looking mare is seldom the best breeder. The brood mare should have a roomy somewhat loose construction rather than the compact closely knit form which is more attractive to the eye. It is a general rule of breeding that compactness should be sought in the male, size in the female. A partial exception to this rule is in the production of draft horses on the farm. Excessively heavy mares would be unwieldy for general farm work: therefore size is

is less risk. The grade animals are just as good workers as the pure bred ones, and unless one is producing breeding stock, the progeny will sell about as well.

It is impossible to be too careful in choosing a stallion. A few dollars in service fee should never stand in the way of patronizing a good stallion. It may mean several dollars on the value of the colt later. Two stallions, one at \$10 and one at \$20, from the ten dollar stallion you may get a colt worth a hundred dollars as a two-year old and from the twenty dollar stallion one worth a hundred and fifty dollars, it costs the same to raise each. Which is the cheaper?

Look out for transmissible defects, faults of conformation, quality, function or disposition. It is not always that the higher priced horse is the best, but if he is, he should be patronized, there will always be plenty of people willing to patronize the low priced one.

There are advantages in the company horse if he is a good one and bought right, but most of them seem to have cost more than they could have been sold for in any other way. Many of them seem to have drunk too heartily also. The cost is not the same to the different shareholders. Sometimes a few shares are distributed for influence and prestige.

The stallion that is worked regularly will generally be a better animal than the one that stands in a box stall. A much better opinion can be formed of his ability, constitution, disposition, etc.

In some cases it may be desirable to raise spring colts in others fall colts. A great deal will depend upon local conditions as to which will be more desirable. Both seasons have their advantages. One advantage of the fall colt is that it is being suckled during the season when the mare is less worked than at any other time of the year and it will be weaned about the time grass is ready, so that the change will probably not be so radical as if it were weaned in the fall and put at once on dry feed. Another advantage is that it will be about the right age for handling, breaking, or training to work in the fall of the year and may be worked lightly during the winter and put at somewhat heavier work in the spring and there is a possibility that it may be brought to maturity at a little less cost than the spring colt.

The advantages of the spring foal are that this is a natural breeding season, the foals are usually stronger, they can spend a greater proportion of their early life out doors and will be less trouble than the fall colts. In any case colts should not be allowed to run with the mares when at work. In the fall they may be left in box stalls. If spring colts, they should be left in the yard or paddock, preferably a grass plot and allowed to be with the mares only when the latter are brought in for feeding during the day. This will be no hardship to the colt, there will be less risk of its being injured, and more work will be gotten out of the mare because she will not fret and the colt will not be in way on the fields.

FROM A COUNTY CHAIRMAN'S VIEWPOINT.

By W. H. STOUT, Piaegrove, Pa.

It was my pleasure to introduce Farmers' Institutes in my home county a few years later than their introduction in some of the counties, and to have acted in the capacity of chairman during this period, beginning under the auspices of the old State Board.

That the work has been of much benefit to Agriculture is not doubted. Beginning under unfavorable conditions with prejudices to overcome, bigotry to contend with, various opposing agencies to discourage attendance, we were even denied convenient and comfortable buildings wherein to meet.

The early institute meetings were held in sheds and livery stables, the auditors being seated upon slabs resting on beer kegs. Slim attendance was the rule, but to-day, we hold our sessions in churches and halls, the audiences are large and show increasing interest. Requests for institutes are coming from all parts of the county.

Improvement in farming is evident in all sections and, while we sometimes feel discouraged, the benefits of institute work is more far reaching than is generally realized. One progressive man, adopting improved methods in a community, soon has imitators, "over-the-fence" farmers, as it were, imitators like their ancestors. These are hauling and spreading the stable manure instead of barnyard manure, while others even purchase chemicals instead of phosphate, because the institute lecturer advocate it.

There remain but a few, too dense to be benefitted, and the missionary work of the Department should be directed especially to aid such as have not seen the light of science and become converted.

The work should be done in those benighted, isolated sections, where the last century methods are still in vogue; where the cows have hollow horns, wolf tails, and lose the cud, so that a gimlet, a razor and a dish rag shall no more be considered as specifics; where the cobs from corn shelled for planting are thrown on the public roads or in fence corners; where the almanac, with its signs handed down by traditions from the time of the shepherds on the plains of Judea conceived the constellations and imagined them to represent beasts, fishes, dippers and chairs; also to localities where witches are believed to practice conjurations and incantations; where sooth-sayers thrive and powwowing is in vogue. There is a vast unexplored field yet to be redeemed from ignorance and superstition.

There are topics other than those of learning how to produce larger and better crops. These are the questions of economics; how to retain more of the fruits of one's labor; how to obtain more dollars for use; more representation and to prevent excessive taxation.

The position of the county chairman is not an enviable one. He is without financial compensation, his efforts often are not appreciated, either by the audiences or the lecturers occasionally. Various questions are propounded by inquisitive auditors, as for instance: "Is he a farmer?" "His hands are so soft, he looks so well fed, fat and plump, puts on such airs of importance; if he has performed such wonders in dairying, poultry raising, general farming or other branches of agriculture, how can he afford to neglect such important industries that are so profitable and trust his work, his home and his daily accounts into other hands?"

Too many eggs, too much butter and milk, too large crops of any kind, too deep plowing, too much cultivating, and to much of the impracticable, casts suspicion upon a speaker. It is better to be moderate and occasionally admit that some mistakes have been made by him, and that better remuneration is derived in serving the State than in performing the duties involved in making records on the farm.

Having served a long time as county chairman, and now being without further aspirations, the friends and good fellows sent into my district may be greeted by some one more ambitious, more talented and better able to perform the duties involved that I, your sometime comrade in the great work of ameliorating the condition of an overworked and underpaid worker in the most important of all industries, that of "the tiller of the soil."

THE SPLIT ROAD DRAG AND ITS USE FOR THE DIRT ROADS IN PENNSYLVANIA.

By D. WARD KING, *Matfield, Mo.*

Mr. Chairman, Ladies and Gentlemen: It seems to me that men from Missouri must have made a reputation throughout the nation for being good-natured. I have traveled from Maine to Texas, and from the Gulf to Canada; I have seen the Pacific coast, but I have never been so far away from home that somebody did not joke me about being from Missouri, and they always expect me to take it good-naturedly, which forms the basis of my thought that men from Missouri must have established the reputation for being good-natured. It happens, however, that in this case the man who comes from the "show me" State, is in the show business.

I am not going to waste any time urging the claim of good roads. This term has been abused. It has been used so continually and emphatically to mean only stone roads, that it has become either a red rag, or a scare crow to the farmer, depending a good deal upon his disposition. If he is a fighting man, he gets mad, but if he is a conservative, peacable man, like most farmers are, he dreads it, because good roads in most instances mean only to the farmer more taxes—taxes that he cannot bear.

Now, I think that in a great many instances farmers are mistaken in feeling that way, but I believe that the strenuous advocates are responsible for his feeling. I have heard men say that they will not be satisfied until every mile of road in the State is covered with stone. It is the utmost foolishness to talk that way. Even if the State could afford to have stone roads on every mile of highway, I do not see how it could afford to keep them in repair. It will be many years before this State has 2 per cent. of its highways in stone; if you come to have 30 per cent., let us say, in order to be conservative, of your roads of stone in the next hundred years, you will have reached the limit. The average farmer on hearing the statement that there must be stone on every road, goes home and begins to figure on how many miles there are in his township, and immediately he sees that if there are 35 miles to be made at an average cost of \$7,000 a mile, it will bankrupt him to macadamize the roads in his township.

Now, the point I am going to make is that you need only a portion of these roads covered with expensive material. On the other hand, there is no more strenuous advocate of stone and gravel roads than I am. I have always said, and say here, that where land is worth \$30 an acre, and stone or gravel can be secured within three miles of the township, if that township does not put stone or gravel on its roads, it is not living up to its opportunities. That sounds dogmatic, but I mean every word of it.

It will be years before you have 10 per cent. of your roads macadamized. These roads must be cared for until that time. For many years to come, from 50 per cent. to 75 per cent. of your roads will have to be cared for as dirt roads. I noticed in the Harrisburg paper yesterday that out of 96,000 miles of road in Pennsylvania, you have 800 miles of State made road. Now, I had the opportunity of examining yesterday, the roads in the vicinity of York, and I spent yesterday in the examination of the roads in Dauphin and Cumberland counties, and I see that you farmers have just as much trouble in getting into town in the spring, as do the farmers of Illinois and Iowa. There was no particular trouble in getting over the roads yesterday, except that in certain places we had to go very slow to get around certain spots. I can pick out certain spots on those roads, dry and smooth as they were yesterday, that six months ago were impossible. Now that is our problem. The important problem in the United States to-day is how to take care of our dirt roads.

Mr. Chairman, no speech on the importance of improving the roads can be considered orthodox, unless some mention is made at sometime during the speech, to the Roman roads, and, therefore, in order that this speech be considered strictly orthodox, I here and now make mention of it, but I ask you to go away back beyond the Roman road. Go back with me to the time when the nations of the earth lived in tents. A historical scene, the tent is pitched. A little slave girl hears that her master, the great man, is afflicted with an incurable disease, and when she hears the news as it comes trickling down through the tented household, she said, "There is a doctor over in my country that cures that disease," and the statement goes back through the household until it reaches the master. It is good news to him, because he has been hopeless. So he takes his

chariots, and his warriors, and rich presents, and goes over to the doctor's house. His case is stated to the doctor, who does not even look at him. Elisha said, "Go bathe three times in the river Jordan." The great man said, "I'll be hanged if I do anything of the kind. We have bigger rivers in my own country than this little stream in this little valley, and if I wanted to take a bath, I would take it there." But his servant says to him, "Master, if the doctor had told you to do great things, you would have been willing to do them; now, this is a little thing; why not try it?" So the great man went and bathed in the little river Jordan, and was helped.

You farmers, and your farm, have been afflicted with the leprosy of bad roads. Will you turn me down because I bring you a simple remedy? "But," you say, "I cannot understand how this thing is done." Do you understand how the Jordan could remove leprosy? Why, gentlemen, there are a thousand things that you cannot understand. Don't turn down the proposition I bring you because it is too simple, I beg of you.

I don't know how better to bring this matter to your mind than by telling you in the simplest manner possible, how we discovered it. In doing this it will be necessary for me to make more use of the perpendicular pronoun than I like, but I am not here to tell you what some one else has done, or what somebody else thinks should be done in order to obtain certain results. I am here to tell you what my neighbors and I have done, and in order to do this it will be necessary to go a little into my personal history.

I will tell you that although I have lived on one farm for thirty years, when I went there I did not know how to put a collar on a horse. I knew a few things; I knew which end of the cow gives the milk, but that was about all. I had it all to learn. And do you know, Mr. Chairman, I sometimes think it was fortunate that I had it all to learn. There are farmers all over the United States to-day doing things simply because their daddies and granddaddies did them. I could not do this because mine had not done it. I had to talk with my neighbors, and ask their advice, and experiment, and finally I did get enough knowledge to run that farm. I was brought up in Central Ohio, in Springfield, and along about '79 I went to Missouri, and bought this farm, which was then about twenty miles from the railway station. The roads at that time were all the way from a quarter of a mile up to three miles wide. When we wanted to go out, we simply hitched up and drove across the prairie. The wheels sunk into the soft mud, and sluices formed between the ridges; then you simply formed another track.

My first road work was with axe and spade. I cut down willows, and dug them into the ruts, so that they would not grapple the horses. Since then I have had experience in all kinds of road-making. Within two years after I went there, the railroad came within two miles of the farm, and established a station within two and one-half miles, and it was not long before a little village sprang up. Between the houses was a strip of land 40 feet in width, which was called a highway, simply because it was legally called so, not because it deserved the name, and the same thing applied to the roads leading to the town. The more these roads were traveled, the worse they got. I have seen them so bad that I could leave my

front door at the same time as my best horse and buggy, and get to town before it did. There was a clay hill on the way to town, and I have frequently found it necessary to rest the buggy on the way up that hill.

Twenty years ago I started trying to interest my neighbors in macadamized roads between certain sections and the town, and I am still trying to interest them. I went to Missouri in 1879, and in 1896 I started the road improvement that has brought me here this evening. I don't know the day; I think I know the month, and don't know why I did it. Just that experimental twist, I suppose. I began the experiment with a pump stock of tall oak pieces. These had been laid on the side about 30 feet apart and held down by nailing strips on about 6 feet apart. Whoever made this implement—I don't know who made it—brought pieces of smooth wire along the pump stock, and brought it back, making a loop, which had been prepared to bring in the corn stalks. Somehow, one day in March, 1896, I happened to have this implement hitched up at an angle of about 45 degrees, and drove down the road, as the quickest way to reach a neighbor with whom I had a little business. The road happened to be dry, but not sticky, and I drove that implement down the road with my two horse team, driving on each side of the rut. I was riding the pump stock. After I was through at my neighbors' I turned and came back as I had gone. Because it was held at an angle of 45 degrees, the pump stock pushed over the surplus earth into the ruts,—all the finer pieces—and carried the larger clods to the centre of the road. I got back home to the front of the house, and looked back and I was one of the most surprised men you have ever seen. It was a wonderful transformation. Figuratively speaking, I stood behind myself, and patted myself on the back, congratulating myself that I had the best piece of road within five hundred miles. And if that road were in no better condition to-day than some of the roads I saw yesterday, some of my neighbors would go out and telegraph me to come home and fix up my road, before I went out to tell other people how to improve theirs. And it is all due to that jagged oak drag, that has changed the habits of the people in the country. And yet, do you know, I kept that up for four years before any one else joined me! Finally a cranky neighbor started in. He waited until he had forgotten how he had laughed at me. By the way, my neighbor is a Pennsylvania Dutchman. We have lived side by side for thirty years, and I never had a quarrel with him. I had a lawsuit with him over 75 cents, and got beat. He and his boys did my threshing for me while that suit was pending. It took Uncle Levi just five years to begin to drag his road; soon another neighbor followed, and then another, until finally the movement spread from the neighborhood all over the State, and from our State into the adjoining states, until today the State of Illinois reports 10,000 King Drags in use, with Iowa, Missouri, Michigan, Kansas, and, I think, Indiana, all having adopted them.

Now, what did I get when I went over that road with that rough drag? In the first place, made a smooth road. Then after I had dragged it for three or four months, I found that it was not only smooth, but that it got dry twenty-four hours before the other

roads did. At the end of a year or eighteen months, it dried forty-eight hours before the other roads did. How did that happen? Well, it is simply one of the two or three things that happened, which I did not expect. Did you ever go to the wood pile, and find out the next morning that you had a splinter in your finger? You did not know how it got there, but you knew it was there. Then the next thing I knew, the hollow that was in the middle of that clay hill, from the top to the bottom, began to fill up. How that occurred, I don't know. I did not start to fill it up. We dragged it with the King Drag, and the rough clods were all drawn toward the middle, and the road filled up, and became hard and smooth. There is a half mile of road there now that has had nothing done to it in thirteen years except what was done by the King Drag.

After I had dragged my road for five years, my neighbors started in, and then, of course, the first thing they began to tell me how I must go about it. How many of you have had that experience, I wonder? You do something, until finally some one adopts the same idea, and then at once proceeds to tell you how it should be done! He knows better than you, of course.

One day I went down the road, and I found one of my neighbors dragging his road, and I said to him, "Isn't it a little wet?" "Well," he said, "it is a little wet, but I thought it was going to rain." Now, Bill Mills knew better than to wait until it rained. He knew if the rain fell, and found the little cups and saucers in the road it would take at least two days longer to dry off. That little elevation in the middle of the road—you people here in Pennsylvania get elevations in the middle of the road, and then you keep out of the middle of the road.

Then another thing happened that I did not expect. One spring we had wet weather in Missouri. It was not a good steady rain, that rained and then was over with, but one of those continuous rains, where for days you will see nothing but clouds, and finally when you do see a little bit of sun as big as a dollar, you run and call all your neighbors to look at that treasure. Within twenty-four hours after the last rain fell, and after two weeks of wet weather, I had the drag out, and begun to drag my half mile track, and you should have seen the result. I was so delighted, that although I did it myself, I got right into my buggy and drove into town, and got the editor. There are two classes of men who get less credit than they deserve; one is the editor and the other is the preacher. I don't see why this should be, unless it is because they are both, unfortunately, associated with the devil. I wanted some one to prove it. Now, at that time all my neighbors between my house and town were dragging. Some of them had just started, some had been dragging for a year, some for two years. And you could pick out the roads that had been dragged for two years, and those that had been dragged for a year. The road that had been dragged for two years showed up so much better than the road that had been only dragged for a year, and that which had been dragged for a year was a big improvement on the road which had only been dragged for a few months. And even those which had only been dragged a short time were much better than those that had not been dragged at all. I was astounded at the result. When I took the editor

home, I loaded up the photographer, and had photographs taken of these roads, to prove my assertion, and Mr. Chairman, this thing has caused me more trouble than anything else in the world.

Now, let us go back again. One of the first things the King Drag does is to obliterate the old wheel tracks. The trouble with most country roads is that a man always travels where the man ahead of him traveled; I don't blame him. There is a place for the wheels, and for the horse, and pretty soon the track becomes a rut, and in Missouri they become so deep in the soft prairie soil that the axle tree begins to drag. Now, by the use of the King Drag, you obliterate the ruts; there is no excuse or temptation for a man to travel exactly where his neighbor did. Here is a road that is equally smooth, and travel is distributed.

Some of you think the roller is good for the road, but how many rollers have you got? Now, out in our country, we stop right there. Our soil there is not so difficult to handle as yours is here. We take only about 30 or 40 bushels of wheat as a wagon load, and an $1\frac{1}{2}$ inch tire is usually used, which gives more roller pressure to the square inch than any roller you can buy. The trouble is that we have been using rollers to slice the road—not to roll it. By distributing travel, we roll them.

Now, there is another thing before I go, which is this. All of you who are farmers know that there are times when if you will place a bucket full, or a tub full of water into a hog wallow, you will find the tub full there in the wallow when the more level places are dry. Now, we go into the garden and dig a hole just like the hog wallow. Then when we have dug the hole, we go into the house and get a tub full of water and empty it into the hole we have just made. Every person knows that before you have finished pouring, there will be nothing left but just bubbles. Now, in the hog wallow, the hogs rolled and rooted around until they have made a waterproof cement out of that hole. What I want to get at is, that you can make waterproof wallows of your roads. Every time it rains, and the roads get wet and are traveled, they get mud hollows. The bottom of the mud hole is waterproof. Now, don't get the idea that some of my newspaper friends get, that I am urging you to use the King Drag to do what the old hog does by wallowing. Now, after a heavy rain you may find 18 inches of solid mud in the road, and then comes another rain, and in traveling that road you will find spouted places. In Maine they call them "honey spots." We call the "seepy" places. Now, isn't it true that in bad weather, these places get in such a condition that when the horse takes his foot out you can hear it pop like a pistol? Then it becomes like stiff putty, and then along the first of July we will have nice, sunshiny weather. Well, what happens? Can't you

All these things come from the use of the split drag. You cannot find a seedy place, or a chink hole, or a culvert, where the drag has been used for a while. And all this can be done for one-quarter or one-third the money expended on stone roads.

Now I might go on indefinitely, but it is possible that you have some questions to ask on points where I may not have made myself clear.

SOIL IMPROVEMENT FOR MARKET GARDENING AND SMALL FRUIT CULTURE.

By PROF. R. L. WATTS, *State College, Pa.*

Market gardeners and small fruit growers in all sections of the country are deeply concerned regarding the improvement of their soils. They realize as never before that crop production is influenced by the character of the soil cultivated more than by any other factor. Good seed and good plants, proper methods of tillage, the control of insects and diseases are important factors and frequently discussed, but the absorbing question everywhere is, how can my soil be improved so it will produce larger and better crops.

The need of soil improvement is apparent. All classes of vegetables and small fruits are limited in yield by soil conditions. Four tons of tomatoes per acre is about the average yield in sections of Maryland where this crop is grown for the canneries, while in Erie county, Pennsylvania, the crop averages twelve tons. An eastern shore grower reports twenty-six tons and Professor W. W. Tracey, of the United States Department of Agriculture, reports ten crops that ran from thirty to thirty-six tons per acre. Asparagus growers generally rejoice when gross receipts amount to \$150 per acre. A New Jersey gardener sold last year \$5,000 worth of asparagus from ten acres. Ten tons of cabbage per acre is probably above the average. A Clearfield county grower, on one and one-third acres, produced twenty-seven tons of Danish Ball Head which was sold for over \$600, and Cornell University reports a crop from a small plat which yielded at the rate of forty tons per acre. Returns from celery usually run from \$100 to \$300 per acre. We sometimes hear of growers whose receipts exceed \$1,000 per acre. A few hundred bushels of onions per acre is secured by most growers, while 1,000 or more are often reported. Two or three thousand quarts of strawberries per acre is probably the average. Successful growers frequently harvest 5,000 quarts. An Oregon producer picked 52,000 quarts from four acres last year, and Mr. Lowell Roundabush, the well-known Ohio Horticulturist, has been selling annually \$60 to \$70 worth of berries from one-twentieth of an acre and he thinks it would be possible to produce 16,000 quarts per acre.

Many other examples might be given to show the wide range in yields. It is sufficient to say here that not two per cent. of our market gardeners and small fruit growers produce maximum crops.

Most of them are doing well, but the fact cannot be denied that yields and profits are greatly limited by imperfect soil conditions.

The purpose of this paper, however, is to suggest means of soil improvement that may be employed by market gardeners and small fruit growers.

DRAINAGE.

All classes of vegetables and fruits thrive best in soils containing a liberal and constant supply of moisture, but none of them succeed in water-logged soils. The first step, then, in soil improvement is to secure good drainage and it is useless to lime, fertilize, manure and cultivate before this has been attended to. To producers of limited capital, the cost of drainage seems high, but the assurance of increased profits justifies the expenditure.

TILLAGE.

Tillage is an essential factor in soil improvement, although its full importance is seldom recognized. We are accustomed to thinking of making soils better by the application of lime, manure, fertilizers and by the growing of clover, cow peas and cover crops, and the value of tillage in connection with these operations is underestimated. Deep plowing and the thorough pulverization of the soil to the depth of the plow furrow are essential to the largest yields. To accomplish this, the plow must be properly adjusted and held by a man who knows how to plow. The harrows must be adapted to the soil and the work to be accomplished. Smoothing harrows and spring tooth harrows have their place on almost every fruit and vegetable farm but they should not be used to the exclusion of disks and spading harrows. These types of harrows are especially effective when used on sods and heavy clay lands.

Another factor of great importance in soil improvement is harrowing at the right time, and, in many instances, the right time is before as well as after plowing. Thorough disking before plowing not only reduces the labor of plowing but results in a finely prepared soil to the full depth of the plow furrow. Every observing cultivator knows how readily the soil pulverizes when harrowed just at the right time. If too wet, much harm is done and if too dry, the clods are pushed aside instead of being crushed or broken. For small fruits and vegetables the utmost care should be taken to secure a fine as well as moist soil. To plow early in the spring and allow the furrows to lie unbroken for days or weeks before harrowing is contrary to the practice of our most successful growers.

THE VALUE OF HUMUS.

Soils poorly supplied with humus are never productive. Without

bank accounts of many Pennsylvania farmers are suffering because their lands are deficient in organic matter. New Jersey truckers as well as fruit growers are giving this question more attention than ever before. Professor W. F. Massey, who lives at Salisbury, on the eastern shore of Maryland, has said over and over again that the urgent need of Maryland soils and of the entire South is more humus. Long Island vegetable and small fruit growers, too far distant from the city to transport manure by wagon, are beginning to realize that yields will soon diminish unless the supply of vegetable matter is increased. Gardeners and small fruit growers throughout the North are agitating the doctrine of more humus, and there is reason to believe that the general discussion of this subject will result in greatly improved soils and increased profits.

STABLE MANURE.

From the earliest history of market gardening and small fruit culture, stable manure has been recognized as the most valuable fertilizer. It not only supplies needed plant food but furnishes vegetable matter in the most desirable form. Enormous quantities of manure are used in close proximity to large cities. A Long Island market gardener, four miles from available supplies of manure, keeps a team on the road daily hauling manure which he applied on eight and one-half acres of land. When the land is occupied with crops, the manure is stacked in huge piles and given time to decay ready for the next year's crops. This particular garden plot is so rich in vegetable matter that it has the appearance of the best greenhouse soils used in the forcing of vegetables. On this little farm, stable manure is employed to the exclusion of all other fertilizers. The owner has very limited knowledge of commercial fertilizers and he has avoided their use. Yields, however, are very large because the soil has been made excessively rich and a perfect reservoir has been formed for the storage of water. The owner informed me that his crops never suffer from drouth. Ritchey Brothers, at Lancaster, Pa., are well known in the community as intensive market gardeners. They apply rotten manure annually at the rate of over seventy-five tons per acre. The acre cultivated is limited but yields and returns are high. The liberal use of manure is the main secret of their success. Mr. M. L. Reutnik, of Cleveland, Ohio, applies fifty tons of fresh horse manure per acre as a top dressing to his celery lands after the plants have attained a height of from six to eight inches. His success is well known throughout that region, receipts running about \$1,200 per acre. Manure is the only fertilizer used by Mr. Reutnik in the growing of celery. W. F. Allen, a well-known, extensive and successful grower of strawberry plants, small fruits and vegetables, of Salisbury, Eastern Shore, Md., depends upon New York manure for his supply of humus. Train loads of manure are shipped and delivered at the siding on his farms at a cost of \$2.75 per ton. He claims that his great success would not be possible without the use of this manure. Numerous examples could be given of men who apply manure lavishly and no class of market gardeners or small fruit growers enjoys greater prosperity.

CLOVER.

The most extensive producers of vegetables and small fruits cultivating large areas should resort to the use of clover in a four-year rotation. This is unquestionably the most economical means of maintaining the supply of humus on a great many Pennsylvania farms. It not only increases the supply of humus but results in the destruction of disease spores and insects which are a constant menace to garden crops. It is not necessary to grow wheat in this rotation. Summer crops are often removed in ample time to sow clover and if the seeding is done before the 15th or 20th of August, in a moist, finely prepared soil, there should be a good stand of clover which would be sufficiently strong before cold weather to stand the winter. The crop may be grown the next year and the second crop plowed down late in the fall or early the following spring for manurial purposes.

CLOVER CROPS AND GREEN MANURE.

The use of clover crops is becoming more general, but there is need of continued agitation in order to demonstrate their great value. Crimson clover is the most extensively used plant for this purpose in New Jersey, Delaware and Maryland and all other sections where soil and climatic conditions are favorable to the crop. It is an ideal legume as a cover crop because, with favorable conditions it is hardy and makes an extensive root system, which probably adds more to the store of humus than the tops unless the plants are allowed to grow much later in the spring than is the usual practice. It prevents the leaching of nitrates and, all points considered, is by far the best cover crop wherever it succeeds.

Rye is the most popular cover crop for northern sections but its proper use is not generally understood. Most growers use seed too sparingly, sow too late in the fall in poorly prepared seed beds and often plow the crop down earlier the next spring than is necessary. A number of examples have come under by observation in this State of men who have made decided improvements in soils by the use of rye and in every case not less than three bushels of seed per acre has been used and in some instances four bushels. Such heavy seeding gives a close stand of plants and if not plowed down too soon in the spring, adds an immense amount of vegetable fibre to the soil. I have often found that it is desirable to allow the rye to attain a height of two feet or more before plowing. This can easily be done if the land is to be used for tomatoes or other crops started late in the spring. In plowing down a heavy growth of rye, it is important to have the plow and chain carefully adjusted so

Some of the best examples of the value of cover crops and green manures can be found in New Jersey. Mr. Horace Roberts, of Moorestown, cultivates about 1,000 acres and no manure is used except that produced by the horses, mules and a few cows which are kept on the farms. His method is rather unique and certainly a complete success. Run-down farms are bought from year to year, planted at once in fruit trees and by a system of inter-cropping and the use of cover crops the land invariably improves in quality, the fruit trees thrive under such treatment and the profits pay for the land before the trees reach a bearing age. The fruit trees are set at usual distances and cabbage, tomatoes, cantaloupes, watermelons, sweet corn, or sweet potatoes are planted between the rows. Early peas, as Alaska, are planted wherever it is possible between the rows of other vegetables. Two hundred and fifty bushels of peas were planted on this farm last spring. The peas are harvested and sold before they interfere with other vegetables and then the vines are cultivated into the soil, thus adding rich material to the store of vegetable matter. This is an excellent plan and should be more generally adopted by market gardeners in all sections of the country. The favorite cover crop on the Robert's farms is crimson clover. It is invariably used if crops are removed soon enough to start clover so that the plants will become sufficiently strong to winter well. If crops such as late tomatoes are not harvested soon enough to start crimson clover, rye is used.

Mr. Lippincott, Moorestown, N. J., is a raspberry grower and uses some unique methods of companion cropping. He not only plants peas, but has found beans to be very good for intercropping, followed by a cover crop of cow peas. Oats would serve the purpose where it is too cool to grow peas. This system is followed during the first and second season after the raspberry plants have been started. A practice of some growers in Southern Jersey is to sow cow peas just as soon as the ground becomes sufficiently warm, plowing this crop down in time to start crimson clover. When some phosphoric acid is used with the peas, a fine growth is generally secured and the clover may be cut for hay or, if needed for soil improvement, plowed down preparatory to starting tomatoes or other vegetables or small fruits.

LIMING.

Lime is just as essential in market gardening and small fruit culture as in general farming. Wherever a legume enters into the system of cropping it is desirable to use lime. The physical character of the heavier types of soils may be greatly improved by the use of lime and it is especially important wherever clover is used in the system of cropping. The importance of its use is becoming very generally recognized in the Atlantic Coast trucking sections. It has been shown recently that some of the soils which have been cropped in vegetables for many years are becoming unproductive and this is due not only to a lack of vegetable matter but to an increase of acidity which is detrimental to the growth of many vegetables. Dr. W. Hull, Waymart, Pa., who is a successful grower of celery, applies lime frequently to muck soil in which this vegetable is grown. He claims that with the liberal application of acid fertilizers, lime is especially valuable and that yields invariably diminish when liming is neglected.

FERTILIZERS.

It is often claimed that commercial fertilizers do not improve soils and they are frequently credited with having injurious effects. The facts remain, however, that commercial fertilizers when properly used are not harmful to soils. Soils throughout the South on which fertilizers have been used extensively for many years have become hard, compact and unproductive. These troubles, however, have not been caused by the use of fertilizers, but by the failure to maintain the supply of vegetable matter. A too common practice is to use fertilizers from year to year as long as the soil responds to their application and a time is ultimately reached when yields and profits are decidedly smaller and no amount of fertilizer will grow big crops. Because of the impaired physical condition of the soil, the grower is apt to blame the fertilizer while the judicious use of cover crops and lime would not only have prevented these troubles but would have materially increased yields.

One of the most important uses of commercial fertilizers in connection with the work of soil improvement is to stimulate crops grown for manurial purposes. It is often impossible on poor soils to secure a satisfactory growth of any crop intended for plowing down without the use of fertilizer. Nitrogen and phosphoric acid are valuable when used for this purpose and potash may also be essential. It often pays to use a high grade fertilizer carrying four per cent. of nitrogen and from six to eight per cent. each of phosphoric acid and potash in the growing of crops for soil improvement.

IRRIGATION.

Irrigation is foreign to the subject of this paper, but it is receiving so much attention at the present time by market gardeners and small fruit growers in the East that a few words on the subject may not be out of place. A liberal supply of humus in the soil is a great insurance against drouth. At the same time, growers realize that their heaviest losses are from drouth. Water is the most important factor in the production of fruits and vegetables. Nearly all of our garden crops contain about 90 per cent. and enormous quantities are necessary in the process of growth. Various methods of irrigation have been used and described, but the overhead systems are becoming most popular among intensive producers. The overhead systems are especially desirable where soil surfaces are too steep, rough or uneven for ditch or tile methods.

The overhead systems are very simple to install. Provision of course must be made for a sufficient supply of water at a fairly high pressure. The plan consists of running overhead galvanized pipes in parallel lines forty to fifty feet apart and supported by pipe posts at intervals of about twenty feet. Special nozzles are inserted in the pipes at intervals of about four feet and a wheel or lever is provided at one end of each run. By means of this wheel or lever, the pipes may be turned in such a manner that several rows of plants are watered at one time and when sufficient water has been applied to certain rows the pipe is again turned slightly and water applied to other rows, repeating this adjustment until the entire area has been covered. It is claimed by men who have tried a plan known as the Skinner System of Irrigation, that it is a most economical and

satisfactory means of watering. There is uniform distribution of the water; it falls in such a diffused mist that there can be no possible injury to the plants; just enough water is used at any one time to meet the needs for a day so there is little possibility of getting a surplus of water into the soil should heavy rains fall after watering. A decided advantage of this system over other methods is that the water is applied in a mist or fine spray, thus avoiding packing the soil and it is absorbed as fast as it falls, preventing hard crusts. Other advantages are claimed for the overhead systems, and it is believed by many experienced growers throughout the East that the plan will be generally employed in all intensive work when the supply of water is ample and the pressure sufficient to insure proper distribution.

MARKET GARDENING AND SMALL FRUIT GROWING FOR A PROFIT.

By R. F. SCHWARZ, *Anatomist, Pa.*

We have been listening with pleasure and, I think, profit, to the interesting papers on, and discussions of, what are known as the larger Farm Topics, such as Fertility and Soil Moisture, Alfalfa, Corn, The Dairy, Sheep, Cattle and Horses, besides Orcharding, and Poultry, and have been impressed by each succeeding speaker with the fact, that his particular line was the special one of greatest importance to the welfare of the country.

But after all, we should remember that conditions are constantly changing, that our population is becoming more and more congested, that the day of the 200 acre or 100 acre farm is going by, and that the time is coming, and coming fast, when smaller areas of land must support the individual.

Intensive culture then must take the place of extensive operations, and the raising for use or sale of fruits and vegetables must be the solution of the living question with thousands of our people.

We in America, have been a meat and flour consuming nation to a greater extent than any other; we have filled our systems with starchy paste, concentrated protein in meat and carbohydrates in fats, and we have become known by reason of this as a nation of dyspeptics. The constantly raising prices of these foods will make it more necessary to supplement them with the cheaper products of the garden and the berry patch, and the great blessing is, that this cheapening will bring with it, also better National digestion and health.

Associations of wealthy philanthropists, are making an effort in our cities to convince the almost starving thousands of the possibilities of the market garden, located on cheap land, as near as may be to cities or towns. The little land league of New York in its platform and prospectus says:

"When the people realize that with 250 days work in a year, two acres will support an ordinary sized family, and produce enough readily marketable surplus to provide money for clothing, and to keep the roof over their heads in good repair.

"When they find that two acres of suitable land can be purchased very near to civilization for from \$50 to \$200 an acre.

"When they understand that a home can be built on these two acres more healthful to live in, far more comfortable with pleasant surroundings and fewer nuisances than in the large city, and that all this can be done for a few hundred dollars, or far less than they now pay as rent in a comparatively few years, when they know that then locating on the land, makes their property as good security for loan as city real estate, and that with no more work at the start, and much less later on, they can establish themselves to much better advantage in the country, and can raise stronger, more healthy, and better minded children than in the city.

"Then there will be fewer men and women walking the streets with the furrows of anxiety worn into their faces, and fewer in the ranks of the unemployed. The hospitals, orphan homes, penitentiaries, jails, reformatories and lunatic asylums will be less numerous, we shall be able to cope with overcrowding in the trades and professions, and life will be better, more satisfactory and more happy for us all."

Bolton Hall, the eminent Sociologist and writer says: "There are within easy distance of New York, Chicago and all our great or greater cities, thousands of acres of good land lying absolutely idle, enough to support almost as many thousand of comfortable homes, while here in the city are thousands of able bodied men and women constantly on the verge of starvation, who should only be too glad to go to the land, if they knew of it, and had any idea of how to make the land keep them, and their families in independence."

I mention this only to show that the men and women of our city realize more strongly than do those of the country the possibilities that lie in the intensive cultivation of land.

So that those of us who are in the business want to get our reward down here on earth, and a more material reward than that of knowing that we are benefiting the digestion of our fellow beings.

Great and from my standpoint unfortunate changes have taken place in the market garden and fruit business in the 33 years I have been engaged in it, and new methods, new calculation, new means of distribution, have had to be applied over and over again as years brought forth these changes.

Then, every neighborhood, even our cities, looked only to its near surroundings for its supply of vegetables and of fruits. Railway or steamship transportation of this perishable produce had not been introduced to any extent, and the man who could first bring into his market town the green onions and radishes and lettuce of spring, the peas and beans and cabbages of early summer, and the ripe tomatoes, sweet corn, and lima beans of the later summer, was the man who could set his price and get it too. To-day, all that has changed, seasons for particular produce have been wiped out, and one might say that there is not a single day in all the year when you cannot in our great city, and even the smaller town markets,

buy fresh tomatoes, cucumbers, and the whole line of perishable vegetables, and also strawberries all grown in tropical or semi-tropical lands, and brought here by modern transportation methods; partly refrigerated, and partly left and exposed to atmospheric and climatic influences, which leave the produce in any but a fresh and healthful condition.

Then, the fruit hunger of the denizens of our towns not surfeited by the winter's daily consumption of oranges, pineapples, bananas, grape fruit, and other less known fruits, but restricted to apples and dried and home canned fruit asserted itself when strawberries first arrived, and the man who brought to that market the first early product of his strawberry beds, could and did realize a handsome profit. To-day Florida strawberries are here in January, followed by Louisiana, South and North Carolina, Tennessee, Virginia, and Delaware fruit, until the great mass of people are surfeited with that delicious fruit, and only willing to give a suitable reward to the home producer for his far higher quality and fully ripe offering.

To show how railroad and transportation interest have encouraged this enormous movement of this class of produce, I have here some interesting figures taken from a recently issued book on the railroad freight rates, in relation to the industries and commerce of the United States.

On potatoes per barrel of $2\frac{1}{2}$ bushels the freight rate is \$1.05 from Florida to New York, 65 cents from South Carolina, 45 cents from North Carolina, and 30 cents from Virginia.

On tomatoes the freight rate per carrier of 6 four quart baskets is 75 cents from Florida, only 45 cents from Texas and 40 cents from Mississippi.

On cataloupes the freight rate to New York ranges from less than 1 cent apiece from the Carolinas, to $2\frac{1}{2}$ cents apiece from California.

Oranges from Florida pay the railroad from 4 to 9 cents a dozen, according to size, and those from California 6 to 12 cents per dozen.

It is true that light as these freight rates seem, they and the cost of package score heavily against the profit of the Southern product, and it might at first sight be thought that this extra tax on Southern produce should be enough advantage to the Northern grower, but against this must be taken the fact of the greatly longer growing season of the far South, and their ability to grow three crops almost and two crops always when we can ask but one from our soil.

If this were all the change, the Northern market gardener might still live in ease and contentment, but it is not all, nor is it the most serious change. The greatest factor in the reduction of prices of such fresh vegetables as are effected, has been the astounding extension and expansion of the great canning industry of the country. The periodical attacks made on the healthfulness of canned vegetables and fruits because of the use of certain preservatives, and coloring matter tend occasionally to check the advance of this industry, but the scare soon wears off, and the use of canned foods keeps on increasing. This may not be true as much in the supply to private homes, but it is true more and more in the supplies of hotels and boarding houses, where year by year, a greater and greater percentage of our population are domiciled. The serious

difficulty in obtaining suitable domestic help aids the canning industry greatly, because it relieves the kitchen help from the tedious preparation of the raw vegetables, and yet how few of us would care for canned goods if they could see, as I have seen, how they are handled in some of the canneries. The soul revolts and the stomach rises in protest at the thought. It is on the par with Dr. Punk's Italian, spitting on an old dirty stocking, and polishing his fruit with it.

There have on the other hand been changes in these 33 years that tend the other way, and enable the market gardener to produce better and larger crops than he did at that time, and to produce these better and larger crops much more cheaply than he could before. These beneficial changes have been in gardening tools and machinery and in the improvement of variety of both vegetables and fruits.

First; considering the improvement in tools, I well remember when in 1875, I purchased personally from S. L. Allen, then in a small up stairs lift in Market St., Philadelphia, the first practicable wheel hoe introduced on the market. Heretofore the hand hoe of various shapes and the rake of different width, had been our garden tools, and how we rejoiced at the quicker and more effective work done by this first primitive wheel hoe. Now, dozens of firms are striving with one another to produce and they are producing, wheel tools with which you can perform almost any garden operation.

Then, we had a limited seed list, the old early York cabbage, the old fashioned and curled and plain lettuce, the Marrowfat pea, a few watery varieties of tomatoes, one variety of high climbing lima beans, and so along the line of all the vegetables were the best we could do. See what the wizards of Horticulture have accomplished since! Solidity, size and weight, have been given to cabbage, to lettuce, and to tomatoes, and the seed has been selected and selected until we can count on 90 per cent. of perfect produce now, where 50 per cent. was the best we could then. Every other vegetable and fruit have been improved in that way, and earliness has kept step with increase in size and quality.

Taking conditions then as they are, what must the modern market gardeners do to derive the greatest profits from his fruits and vegetables? And in considering that question, I must consider as well, him who like Professor Watts, located where the market is ready, as him who living away from market with his land on his hands, has the greatest difficulty in disposal of his crops.

First, then, we must study the possibility of our market, and grow those things which seem to promise us the greatest returns. If the most promising crops are cabbage, tomatoes, and corn, then let us devote all of our energy to perfect productions of these. If a greater variety of produce promises results, let us grow that greater variety; that question solved, will determine the amount of greenhouse, hot bed, or cold frame, glass surface, we need; for even if we have no market for winter crops grown under glass, it is essential that we produce our own plants, especially of cabbage, cauliflower, tomatoes, egg plant, and peppers. I would rather trust the reliable seedsman than the wholesale grower of plants to give me the special variety I prefer and want. The latter is too often apt to substitute, and many failures of profit in crops have been due to such substitution.

Second, we should so fertilize our soil, whatever it may be, that it will be able to give us ample and full returns in the crops we ask of it, this part of the subject, however, has been assigned to Professor Watts, and I shall leave it alone for the present.

Third, we should and we must so thoroughly and completely prepare that soil, by proper and deep ploughing, by disking, by harrowing, and by cultivating that every clod is crushed, that every lump is pulverized, and that we have the most perfect condition of seed bed it is possible to prepare. Only by doing this can we bring those two most absolutely necessary elements of success, fertility and moisture, together in such combination as the crops we propose to grow demand. Always remember that excepting only the case of the severest drought our supply of moisture depends on the preparation of the soil, and on the constant ever repeated cultivation of our crops after planting. Also remember, as Professor Shaw has pointed out to you, that we need thousands of tons of water in our soils for ordinary crops, and additional thousands of tons for our vegetable and small fruit crops.

Fourth, this expensive supply of fertility, and this expensive cost of preparation entitles us to demand from the soil constant exertion, constant work, that we may find our profit and reward, and to have that reward as great as possible we must plant as closely as possible, and obtain as many crops as we can from the same soil; thus we plant early cabbage and lettuce, cabbage and horse radish, parsnips and radishes, beets and early turnips, peas followed by celery or cabbage, beans followed by cauliflower or celery, onions intersown with spinach and radishes; always making such combinations as will prevent the interference with one plant of the other. We now carry this to greater extremes even in small fruits.

Our early corn, and potato fields are interplanted with strawberries, in the rows of strawberries are planted raspberries, 4 feet apart, and every 20 feet a peach tree, this gives us the corn and potatoes for this year's crop, the strawberries for next year, the raspberries for the next three years, and then the peaches, cultivating as best we can, and saving a year's time on the small fruits, developing for full fruiting.

This growing of crops is necessary as I said before, to repay us for the manure, the large quantities of highest grade fertilizer and the constant working of the soil.

Fifth, the use of the best, the most suitable, the most perfect machinery of all kinds, is essential to our success, since old fashioned tools and implements could not be worked in the small spaces we leave between rows. We must produce cheaply, and yet we must produce the best that can be raised to obtain and hold our market, and too much emphasis cannot be put on the proposition that we must make up our minds to accept.

Give us a soil as free of stones and rubbish as possible, give us the manure and fertilizers, give us the implements and the workmen and if we understand our business, we can excel and in that excelling, lies our profit, let the market be what it may.

On land less smooth, and therefore less adapted to intensive close planting, we can grow blackberries, blackcaps, and red raspberries, interplanting these for the first two years with crops of sweet corn

and giving the best cultivation possible on rough land, and even there, we can and do obtain results far outreaching the returns from any ordinary farming.

Profits in the productions of fruits and vegetables may not be as great as they once were, but in spite of all drawbacks,—the constantly increasing population and the lesser inclination of the town dwellers to have his own garden, and the consequent possibility of disposing of larger quantities still leave a field to be worked profitably, though the slipshod and slow methods of the past must be relegated to the past, and for the gardener or small fruit grower of this day are required, high aim, application of constant study, a more full and deep knowledge of the soil and of plant growth, energy, perseverance, and last but not least, brains.

CORN IMPROVEMENT BY SELECTION, BREEDING AND TESTING.

By PROF. F. D. GARDNER, *State College, Pa.*

At the present price of corn, ten kernels added to each ear produced in Pennsylvania would add to the pocket-books of the Keystone State farmers \$780,000.00. Although Pennsylvania is not one of the great corn states, this will give some idea of the importance of the crop. By a little attention to the selection and breeding of seed corn, the crop can be increased by this amount not only next year, but for several years to come.

I am loath to suggest any thing that will make the farmer more work, but I know of nothing that will come so near producing something for nothing as that of giving a little time and attention to the improvement of corn by careful selection and breeding and to securing a full stand by germination tests and careful planting.

SECURING SEED.

When a farmer is dissatisfied with his corn he should secure new seed. He should not send far away for it, but should purchase of a reliable grower who produces it under climatic conditions and on soil similar to that on which he is to grow it. It should be purchased in the ear so that he can see if it is as represented in regard to type, size and uniformity. It is not enough to merely start with new seed, but he should still further improve it by selection and breeding, so that it will be suited to his soil and conditions. If he can't do this, he should purchase each year, seed that is selected and bred for his conditions.

It is just as important to use well-bred seed corn as it is to breed from an animal having a good pedigree. The same principles apply to the breeding of both plants and animals. Five dollars per bushel is none too much to pay for good seed corn. Well bred seed corn will produce from 5 to 20 bushels per acre more than seed to which

no special attention has been given, when grown under identical conditions. A bushel of seed will plant six acres. Ten bushels increase on each of six acres equals 60 bushels. This at 60 cents per bushel is \$36.00, the value of a bushel of good seed.

SELECTING SEED.

Selection should be made in the field where both plant and ear can be seen. Good plants should be of moderate height. Short nodes or joints are preferable to long nodes for each node bears a leaf. The more the leaf surface the greater the power of the plant to manufacture the elements of air and soil into corn. The leaves are the most palatable, digestible and nutritious part of the forage. The plants should be free from smut, rust and any other fungus disease.

The ears should be attached to the stalk at a convenient height of about four feet and by a shank of moderate length and thickness. When too long, the shank allows the ear to pull the stalk over and when too short the ear is too erect and may be damaged at the tip by allowing water to enter the husks. The husks should be moderate in amount and sufficiently long to cover the tip of the ear, and protect the kernels from insects, birds and damage by rain.

A good seed ear should be eight to ten inches long, (for a medium maturing variety). The circumference two-fifths the distance from the butt should equal three-fourths but not exceed four-fifths of the length. The form should be cylindrical or but slightly tapering from butt to tip. The tip and butt should be well filled with kernels and the rows, sixteen to twenty in number, should be straight and carry out well to the butt and tip with kernels of regular and uniform shape.

The depth of the kernels should equal one-half the diameter of the cob. Kernels five-eighth inch long, three-eighth inch wide and one-sixth inch thick are a good size. The tips should be strong and full for such indicates good vitality. The embryo or germ should be large and extend well up toward the crown. Large embryos produce vigorous plants and indicates high fat and protein content and consequently high feeding value.

CARE OF SEEDS.

After selection, the seed ears should be well cared for by storing in a dry and well ventilated room and out of the reach of rats and mice. If thoroughly dried, corn will stand a very low temperature without injury, but if not well dried temperature not far below freezing will injure or destroy its vitality or germinating power and make it worthless for seed.

VITALITY TEST.

The importance of securing a perfect stand of strong plants in the corn field cannot be overestimated. Aside from field conditions favorable to germination and the proper placing of the corn in its seed bed, there are two dominant factors on which perfection of stand depends: First, the vitality of seed. Second, requisite number of kernels in each hill or regular and uniform spacing if planted in drills.

A vitality or germination test of seed corn should always be made. It should be made several weeks before the seed is required for planting so that there may be time to secure a new supply in case the seed has been injured. March is a good time to make the germination tests. There are many simple methods for making such

tests, but in all cases each ear should be tested. Experiments indicate that five kernels taken from each ear is sufficient to determine whether or not the ear should be used for seed. The kernels should be taken one from near the butt and another from near the tip and the other three at about equal intervals along the length of the ear, rotating the ear so as to take them from different portions of the circumference. These five kernels should be placed in a compartment of the germinator and the ear marked or so placed that it can be located after the test has been made. The requisites for germination are air, warmth and moisture. The temperature of the living room or kitchen is about right providing it does not fall below forty-five degrees at night. A satisfactory germinator can be secured by making, out of seven-eighth inch pine lumber, a shallow tray one and one-half to two feet square and about two and one-half inches deep. The sides of the tray should be made preferably out of seven-eighth inch lumber, while the bottom may be made out of one-half inch material. The tray should be filled to within an inch of the top with thoroughly wet sawdust, or if sawdust is not available, sand or ordinary soil will answer the purpose. Place over the sawdust a piece of muslin the same width as the tray and twice as long, marking one-half of it into small squares about one and one-half inch each way and numbering these consecutively. The marking may be done with an ordinary soft pencil or preferably with an indelible pencil. The seed ears to be tested should be arranged in rows on the shelves of the seed house, or on a table or on the floor. Beginning at the left hand end of the upper row take five kernels from the first ear, calling this No. 1 and place these five kernels on check No. 1 of the marked cloth in the germinator. From ear No. 2 take the same number of kernels and place in check No. 2, and so on until all checks or squares in the tray are occupied.

In removing the kernels from the ears one should be taken from near the tip, another from near the butt and three from the intervening portions of the ear, revolving the ear as the kernels are removed, in order to secure representative samples of the corn. When the germinator has been filled, the unmarked half of the muslin is folded over the kernels and a layer of about one-half inch of thoroughly wet sawdust is spread over this. When the germination is completed the upper sheet of the muslin is turned back, sawdust and all, in such a manner that the corn is plainly visible, and one can see if any kernels in any checks have failed to germinate. Any ears which failed to give five kernels that germinate vigorously should be rejected. A handy man working systematically can test five or six bushels of corn in a day. It is work that should never be neglected and will pay for the labor involved many times over in the better stand and resulting larger yields of corn.

PREPARATION FOR PLANTING.

Before shelling the corn for planting it is important to remove all irregular kernels from the butts and tips of ears, not because they will not produce just as good and vigorous plants as the kernels from the middle portion of the ears, but because of their irregularity that will not allow them to pass through the corn-planter with uniformity. A planter cannot drop regularly unless supplied with kernels of a uniform size. Probably all of you have attended the country fair

and doubtless may have observed the exhibit of corn planters along with the other agricultural machinery and have been impressed with the uniformity with which the planter dropped a definite number of kernels on the endless belt as it passed slowly beneath the shoe of the planter, but you may have failed to note that the few quarts of corn that was used over and over again in that process was remarkably uniform in size and had probably been hand-sorted. Aside from removing the irregular kernels at the tips and butts, the ears before being shelled, may be assorted into two or three lots according to the size of kernels and the shelled corn from each kept separate so that the planter plates may be adjusted to each size. The same results may be secured by the use of two sieves, one with meshes sufficiently large to let the small and medium sized kernels pass and the other of a size that will let only the small kernels pass. There has recently been put on the market by the Monarch Self-feeder Co., of Cedar Falls, Iowa, a corn grader consisting of a cylinder having different sized openings through which the corn is passed. Such a grader would no doubt give greater uniformity than could be secured by flat screens.

The planter should, of course, be carefully adjusted to each lot of seed. A poorly adjusted machine may offset the advantages that would be derived from the carefully selected and graded seed, and the adjustment should therefore never be neglected. Many corn growers would be surprised to learn how imperfect a stand they have. It requires an actual count of the number of missing hills on an acre and those that have less than the required number of plants to the hill to learn the truth.

As a result of investigations made by the Indiana Experiment Station in 1907 in numerous fields in various sections of that state, it was found that the average farmer secured not more than three-fourths of a full stand, when in reality he should have from ninety to ninety-five per cent. of a stand. If three-fourths of a stand will produce forty bushels to the acre, what will ninety-five per cent. of a stand produce? The observing farmer will soon learn that it pays well to spend time in preparing his seed corn.

WHAT IS A STAND?

A full stand for one soil or locality may differ materially from that of another. Obviously it depends on the fertility of the soil, the character of season and the variety of corn. The more fertile the soil the greater the number of stalks that may occupy an acre and each produce an ear. The more favorable the growing season the more stalks may occupy an acre and the smaller the variety the thicker it can be planted. On land of good fertility 10,000 plants to the acre is a good stand. With hills three feet eight inches each way and three plants to each, an acre would contain 9,720 stalks. When planted in drills one kernel every fourteen inches with rows three feet eight inches apart, an acre will contain 10,179 stalks. On good soil and for average years I would suggest that these rates are the most desirable for the production of corn. If planted chiefly for fodder or silage, the rate of planting may be such as to produce a third more plants.

THE BREEDING PLOT.

The breeding plot should be on soil representative of that on which the general crop is to be grown. A common mistake of the beginner is to select unusually rich ground or to pile on abnormally large amount of manure or fertilizer. A thorough preparation of the seed bed and the best of cultivation is desirable, but aside from this the soil conditions should be representative of the average so that the corn will develop normally. The plot should be as far removed from the general corn field as possible unless the seed has been selected from the general crop, in which case, if necessary, the plat may be in one corner of the general field, but preferably in the corner from whence the prevailing wind comes at the time pollen is flying.

The ear row method of breeding and improving corn is the most satisfactory, in fact the only rapid way of improving corn along any line. This method is based on the principle that like begets like, but fortunately this law is not rigid. If every kernel on this ear should produce an ear just like this (exhibited good ear) you would doubtless be well satisfied with the results, but it would exclude the possibility of the further improvement of corn. It is the variation in the progeny of any parent plant that enables us, through selection, to improve the variety, and it is the tendency for like to produce a large percentage of progeny, differing, but slightly, from the parent that enables us to make progress in plant improvement.

Corn improvement by selection is easy because the plant is large and its characteristics plainly visible; because the variations are sufficiently marked and frequent to enable man to select individuals with desirable characteristics, and also because of the large number of plants that can be secured from one individual and the consequent rapidity of multiplication.

Corn breeding is somewhat more difficult because of the natural cross fertilization and the impracticability of keeping the breed pure, and also because close and self-fertilization are difficulties that must be guarded against.

None but the choicest ears selected for desirable qualities of both ear and plant should be used in the breeding plot and any ears that do not show a higher standard in the germination test should be rejected. These desirable ears, usually 80 to 100 in number, may be subjected to a still more rigid selection by dividing into two equal parts, putting the choicest ears all in one lot. The ears from the choicer lot are to be planted each in a separate row and those from the poorer lot may be shelled together and used as bulk seed with which to plant the alternating rows of the breeding plot.

It is well to plant the individual ears in the even numbered rows commencing to number from one side of the plot. The rows should be sufficiently short (usually not more than 400 feet long) so that the corn from each ear may not fail to plant the row. The planting should be made as uniform as possible. It may be done with a planter by removing and changing the seed for each row. A careful record should, of course, be kept of the breeding plot.

Self pollination is generally conceded to be injurious in a naturally cross pollinated plant like corn and a number of experiments at several of our State institutions have demonstrated the assumption to be correct. The progeny of a self fertilized ear of corn may be remarkably uniform, but the plants are usually much reduced in size and vigor and the yield has been reduced to less than half of that from

the same variety when cross fertilized. If self fertilization is so injurious, it is reasonable to suppose that close fertilization, i. e., the interbreeding of closely related individuals would be injurious, but of course to a lesser degree. We have no assurance that no self fertilization takes place under ordinary field conditions, in fact it would seem probable that a small percentage of the kernels of every ear will have been fertilized by pollen from the same plant and it may be that this is largely responsible for the abortive and inferior plants that always occur in every corn field in greater or lesser numbers, no matter how favorable the conditions. It also seems certain that the bulk of the kernels of any ear are fertilized by pollen from individuals growing in the immediate neighborhood.

In the breeding plot we are using a limited number of individuals. Half of them are planted each in separate rows, all stalks in such rows are therefore closely related being from a common mother. Under these conditions the tendency for close fertilization will be greater than under general field conditions, and unless steps are taken to prevent this it may offset the improvement which we are striving for through selection and breeding. Under these conditions it is probable that twenty-five per cent. of the kernels in the rows planted from individual ears would become self and close fertilized. To eliminate this, detasseling of the rows planted from individual ears has been resorted to.

At tasseling time the tassels are removed from the individual ear rows as soon as they appear. They should also be removed from all inferior abortion or undesirable stalks in the other rows. It is necessary to go over the plot every day during the tasseling period as all tasse's do not appear at the same time. The tassels can be pulled out without injury to the stalk. If the corn is tall the work can be made easier by riding a steady horse and using a muzzle to prevent injury to the corn.

HARVESTING THE RECORDS.

At harvest time records are made from each detasseled row, showing the stand, per cent. of suckers and barren stalks, as well as other characteristics. Seed ears are then selected from sixteen of the most desirable rows and those from each row kept separate and given the number of the row. The rows are now husked, the corn from each, including the ones which were not detasseled, being kept separate and weighed. The object of ascertaining the weight of corn on the tasseled rows from which no seed is selected, is to ascertain the relative yield of the rows from which seed is taken. This is done by comparing the yield of each detassled row with the average yield of the two adjacent rows which were from the bulk seed. Of course, the weight of the seed ears already taken will be included in the rows from which taken.

The seed ears are now stored in a desirable place as previously suggested and so labled that reference can be made to records for the rows from which each lot came. In the Spring, after the germination test has been made, the five best ears or the requisite number are selected from each of the best eight rows and are to be used as the individual ears for the second years breeding plot. The same number of best ears are also selected from the remaining eight rows and used as the bulk seed for the second year's breeding plot. The

remainder of the seed may be used either for a part of the general crop or may be used in a small field by itself to produce seed for the next year's crop.

Work of this character systematically followed up will work wonders in the improvement of corn on any farm, and if considerable corn is grown the time will be well paid for. For the small grower it may be more economical to purchase well bred seed. At the present price of corn seed that will produce five bushels per acre, more than that formerly used, is easily worth \$20.00 per bushel. "Five per" is none too much to pay for well bred seed.

TWENTY YEARS EXPERIENCE IN CORN GROWING AND BREEDING.

By L. W. LIGHTY, *Belleville, Pa.*

Ladies and Gentlemen: It has been my pleasure to do a little teaching along this line at Farmers' Institutes for a number of years. It has been my great pleasure for more years to do a lot of work on the farm along this line. Very often at Farmers' Institutes we are told—well, I don't want to say we are told—the farmers say that these things all sound very nice on the platform, but they don't work out on the farm. Is that a fact? Is it true? I stand here to-day to tell you that I can never repay what I owe to our scientific investigators who made it possible for me to grow larger crops. You have all listened to that excellent address of Prof. Gardner's, and I suppose if you were to listen to me, you would only listen to a repetition of what you have heard before, told better than I can tell you. If you were to go to sleep, I would not blame you, but I will not talk very long, and possibly you can stay awake. Furthermore, I am glad that there are some of my own neighbors in the audience to-day, and I want them to tell you people from a distance if I am not telling the truth, when I say that by the practice of the theories I have heard here I have made an improvement of 1,000 per cent.—Brother Hall, is that too high?—I want to tell my friends that by the application of the theories that are laid down by the investigators, we can do just what they tell us we can. We can increase the yield of our corn by the intelligent application of the principles they lay down. Of course, we cannot take those principles and use them like a machine—and you would not have it so, although there are some people in some sections of the country who think this is the way it should be done. The principles that are laid down are general principles that must be applied in many sections of country, with many experiments, and under many different conditions.

Now, when I was up in Potter county with Brother Hall, he told me that they have frosts every month, and they have to plant a variety of corn that ripens very quickly, and of course this particular ear that the Professor showed you would not be desirable up there on their high hills. These men have to work out their own problems, and

have to work out the principles Professor Gardner laid down for them, and at the same time use their own good judgment in working them. My farmer friends, we have to use more good judgment—more brains, put there on that old farm than any of the lawyers in the city of New York, than in any other profession, if we want to make a success out on that old farm. What we have to do is not written in books, but when we go up against nature, when we are dealing with the Almighty, we have, more than any other class of men, to use our good judgment and brains.

My experience has been varied. I have had many failures and I learned more from my failures than from my successes. The first thing I learned is that the soil is the most important factor. I don't want to tell you about the soil. That has been done over and over again. I don't want to tell you about it: I simply want to emphasize the fact that if we want to grow a large crop of corn, we want to have that soil in such a condition that it will take up and hold for that soil a large quantity of water. Now, there are some of my neighbors here this morning, and I want to say to them that we have a large amount of big crops of corn here in York. We have some good soil, and some that is only ordinary. We grow big crops to-day, but I recollect the time when we grew larger crops of corn on the hills and valleys of York. We are growing less corn than our forefathers did. Why is that? We got these fields from our good old red friends of the forest; nature had put them on the limestone rocks, and the spring rains and the snows dissolved, and there was much of that vegetable matter called "humus" in the soil to hold the moisture. And then in many cases nature had an almost perfect system of underdrainage. The great trees that grew up and then fell down and mixed with the soil—the leaves from the giant oaks, hickories and shellbarks decayed, and filled that soil with humus. They did not need any of the ingredients we have to-day. They never heard of the commercial fertilizer, of which we have so much need to-day. They did not even have a Farmers' Institute to teach them how to grow corn, and yet they grew it better than the white man. The red man got more corn without labor, without fertilizer, and without thought. After we have worked hard, and put on fertilizer, and used our brains, we can grow only an average crop. Why is that? With our methods of farming, we have taken out the fertility that nature has placed there. We wanted the corn—we wanted the money that the corn would bring, and we used up the vegetable matter in that soil. Even when I was a boy men said "our corn and our crops are not doing so well as they did when we were boys." What was to be done?

Well, these hills were filled with limestone rock, and they somehow learned that if they burned that rock and put it on the soil, it would fill that soil with humus and grow more corn. So they put on the lime in great quantities. Subsequently the limed chewed up the tough vegetable matter that was still in the soil, and the corn crop grew less and less. You see it works this way: Sometimes you see a horse that does not get enough oats; I have seen such horses in the upper part of York county. When you do not get quite enough work out of that horse, you speak to him kindly, and he will perhaps try to go for a little while; but he stops again, and then you speak to him roughly, and then he gets the whip; but the time comes when the horse does not mind even the whip. You

see, what that horse needed was oats, and not the whip. Vegetable matter is what this soil needs, and not the whip. Yesterday in going down to York Haven I saw hills entirely barren, without vegetation of any kind, and yet that farmer knew it and put the whip on it. But he will not get a good crop until he first fills that soil with vegetable matter.

Now, how do we get that soil back to its original condition? We never can, but we can approximate it, and I believe there are quite a number of farmers here who will say that that can be done, as the result of actual practice on the old farm. The best and cheapest method is to apply it in the form of a heavy sod to plow in. Never plow again unless you have a heavy sod to plow under. You will be astonished at the amount of vegetable matter you put into that old soil. I did that, and I have got a good soil. There are times when a man must make a quick sod, and it is wise for a man who has to depend on his dollars, to always have a sod to turn under whenever he wants to plow. I want to say to you, my friends, that I have practiced this for many years on that old farm right up here in this county. I never plow unless I have a sod. I do the same thing for wheat. If you get this sod and plow it under, you will be practically sure of a good corn crop. The sod to plow under is the best guide to successful corn culture. I don't care how pretty the ear is, or how many rows it has, or whether it will take the first premium at the National Corn Show, if you don't get your soil full of humus before you plant that seed, you will have a poor crop of corn.

SOME COMMON ORCHARD AND GARDEN INSECTS; HOW TO CONTROL THEM.

By WM. H. WOLFF, West Chester, Pa.

Mr. Chairman, Ladies and Gentlemen: While it is not well to speak boastfully of what has been done, yet I can assure you to-day that the State of Pennsylvania is well to the forefront in the great work of insect control. You will note, too, that I said "work of insect control," for it is indeed a great work, and it has been conducted in this State in a workmanlike and businesslike manner. The State of Pennsylvania has been liberal in its appropriation to this work and the people

general market to pay the prices due to such crop deficiency? It is therefore plain to be seen that this work of teaching the control not only of insects, but of the various factors governing the crop production, must interest, or at least does equally concern the entire citizenship.

The agencies through which the teaching of insect control is done in Pennsylvania are mainly three: The Pennsylvania State College, the Division of Zoology, and the Division of Farmers' Institutes. Each carries on its own work more or less independent of the other two and in its own special field. The work of State College is mostly that of instructing the attending students; field experiments are also always in progress. The Division of Zoology reaches many thousands of citizens through its monthly bulletins and county demonstrations, while the Division of Farmers' Institutes comes into personal touch with thousands more, through its traveling schools, its lectures and its winter institute work.

The result of all this is a growing confidence on the part of the farmers and horticulturists of the State, born of a certain knowledge of the fundamental principles of insect control. Thus we find a great amount of tree planting is now going on. Pennsylvania nurseries are now selling four or five times as many trees for planting within the State as they did a few years ago.

The nurserymen themselves, also a few years ago in dread of the extermination of their own industries by San José scale and other insects, have now been shown that these tree and plant enemies may be held in subjection by correct methods.

Have we ever stopped to consider fully enough what the quality of perfection in orchard and garden products means? The production of perfect fruit and perfect vegetables cannot occur in a state of nature, but perfection in horticultural products if often to-day seen on the markets, and in every case where it is seen, it is to be attributed to applied science and applied art. The work of insects is only one of the many natural factors tending to prevent perfection in our fruits and vegetables. A very closely related and co-ordinate factor is that of plant diseases. It is in perfection in quality, combined with large yields, that the profits are to be realized to-day, and the factors governing this are so complex that we feel that we can well advise growers to specialize as much as possible with a few crops so as to become thoroughly familiar with those special crops, their requirements and their enemies.

In general, there are a comparatively few insects every season which, more than others, cause us great trouble, but it must also be remembered that almost any insect may become a great pest under certain circumstances. I therefore wish to speak to you of a few very common and troublesome insects, and the most recent developments in their methods of control.

Every one here to-day has heard and read a lot about the San

First, in dealing with materials for the control of the San José scale, we must speak of the lime-sulfur mixtures. The home-made boiled lime-sulfur mixture has until very recently been the only material officially recommended by our Pennsylvania Division of Zoology. Lately the commercial concentrated lime-sulfur preparations have been recommended. The standard home-made boiled lime-sulfur wash has, when well made and thoroughly applied, given first-class results. This is generally admitted. There is much difficulty and labor attending its preparation and application to the trees, so much so, that many of the largest orchardists has substituted for it the soluble oils. From my own personal experience, the results of observation in the orchards of others, and the published results of experiments, I am confident that as good results are obtained from the use of the best oils at a strength of one part to fifteen of water on apple and pear trees, as with the best lime-sulfur mixture. For peach and plum, however, I prefer the lime-sulfur mixture, applied just before the buds open in the spring, to anything else.

A home-made concentrated lime-sulfur mixture is now prepared on a formula which calls for two pounds of sulfur and one of lime to each gallon of water. These are boiled together for one hour, and finally diluted, one part of six of water. The material may be kept in a concentrated form and the dilution made just before it is applied to the tree. Owing, it is thought, to the higher sulphids formed by the excess of sulfur, there is no crystallization on cooling as is the case with the standard lime-sulfur mixture. I have made and used some of this material at the strength of one to six, and one to four of water, but the experiments are not yet far enough advanced for a definite and certain report. I advise growers who favor lime-sulfur to prepare some of the concentrated lime-sulfur and give it a good fair trial. If it proves a satisfactory spray in scale-killing power, it has many strong points to recommend it. It will keep in a concentrated form without crystallizing, has very little sediment, and costs not over one cent per gallon.

The soluble oils, since they first came on the market as a remedy against San José scale, have, as a class, not received favorable comment by our Pennsylvania Division of Zoology. The use of these soluble oils, however, we find is becoming more general, and many of our best Experiment Stations are now recommending them. Maryland, New Jersey and New York and other states, have now endorsed their use in orchard work. We also find the largest orchardists in this State and elsewhere using freely these soluble oils. These oils have many good points to recommend them. First, it has been shown that those made on a crude oil or paraffine oil basis will kill the scale at a strength of one part to fifteen of water. Secondly, they invariably give a perfect emulsion when simply mixed with water as directed. Third, the labor and delay of boiling, and the delay of nozzle clogging are done away with. Owing to the rapidity of the work thus made possible, the ability to start spraying ten minutes after arriving in the fields in the morning, and the greater surface covering capacity of these oils, it is usually found that the work can be done about as cheaply and much more pleasantly with a soluble oil costing two and one-half cents a gallon, as with the lime-sulfur mixing costing one-half that amount. Prof.

Penny, of your own Pennsylvania State College has done a great deal of work on these soluble oils, and in the early part of this session presented to you the results of several years of study. He has presented to you the method of manufacture of a home-made soluble oil on a paraffine basis, the cost of which, applied to the trees is much less than that of the boiled lime-sulfur mixture. Under Prof. Penny's directions, it has been my privilege to make in the spring and fall of 1908 and again this past spring in an experimental way, several hundred gallons of this material. I have used this soluble oil on apple, pear, peach, plum and cherry, at a strength of one part to nineteen of water, and have killed every scale, entirely cleaning up badly encrusted trees. So far I have seen no damage to these trees, and I would recommend that each of you make and try some of this new soluble oil. It is simple to make. I have made several batches and each time have secured a good emulsion.

In my work in the last three years, I have had to use about thirty thousand gallons of "Scalecide," and I can assure you I have yet to see one twig or flower injured by its use, while the trees were dormant. This material will kill every scale covered with it, when used one part to fifteen of water. It is waste to advocate its use stronger than this.

In the past, many times it has been thought necessary to enforce the destruction of many blocks of nursery stock, because found badly infested with scale in early summer. In the case of apples, pears and plums, such destruction will not again be necessary if the nurseryman will only get busy. Mr. Grubb, a student of Cornell University, demonstrated in private nursery experiments during the summer of 1907—and I have many times verified his results—that an emulsion made with naptha soft soap and containing 23 per cent. of kerosene oil, may be applied to apple and pear in summer when the trees are in full foliage, and that this will kill every scale with no apparent damage to the trees. If the spraying is done by August 1st, the scale will fall off and the marks disappear by the end of the season. Care must be taken to cease spraying before the mixture drips and runs down the stem. The application should be made on a bright, preferably a windy day, should be put on as a fine spray, and the spraying should not be repeated at a short interval of time.

In a like manner, plums may be cleaned of scale in the summer while in full foliage by the use in a similar way, of an emulsion containing 17 per cent. kerosene. Just why 17 per cent. suffices to kill all scale on plums and 23 per cent. is required on apple and pear, I cannot say, but experiment shows this to be a fact.

The Codling Moth of the apple, pear and quince is another insect causing yearly immense losses of from fifty to eighty per cent. of the fruit on trees not sprayed. The Paris green spray with lime, or in Bordeaux mixture, or the lead arsenate spray, applied as a fine mist, have heretofore been advocated. Two applications at least have been deemed necessary. Prof. Melander of the State of Washington early this spring advocated a practically new method of spraying for Codling Moth. He uses lead arsenate, and one and one-half pounds to fifty gallons of water and applies it at very high pressure, using the Bordeaux nozzle, and obtaining a coarse-driving fan shaped spray. Instead of allowing the spray to settle down over the tree as a mist, this coarse fan shaped spray is directed

straight against and into the little open calyx cups of the forming apple. With one good spraying in this way, he finds he can get better results than with several mist sprayings even when the liquid contains twice the amount of lead arsenate. I have sprayed some apple trees by this new method this spring, and I hope to report comparative results later. It is my opinion that when trees are sprayed for codling moth with this heavy drenching spray, that in order to avoid possible serious Bordeaux injury, the strength of the Bordeaux mixture will have to be reduced, or the Bordeaux spraying will have to be done separately. Indeed, some of our best orchardists are now aiming to substitute the self-boiled lime-sulfur mixed in the place of Bordeaux, owing to the apparent risk of damage from the Bordeaux.

Apple Tree Borers are also the cause of the loss of many fine trees of all ages. The Tyson brothers in their famous orchards of Flora Dale, Adams county, have for the past six years been painting the stems of their apple trees from two inches below the soil surface to a height of fifteen inches with pure white lead and linseed oil. All sizes of trees have been treated, from one year old whips to fifty year old trees, and the results have been most satisfactory in keeping out borers. The trees, as a rule, are re-painted every other year.

One ply tarred paper wrapped securely and tied top and bottom about the base of peach trees is reported on good authority to give first-class protection from the peach tree borer. This wrapping of tarred paper should extend, as in the case of the painting of the apple tree stem, from two inches below the soil level to fifteen inches above, and it should be put on in early spring after the trees have been thoroughly gone over, and the borers in them removed.

So far I have not said anything of garden insects, but there are a few which I must hurriedly mention. With the increased interest and large profits derived from asparagus culture, larger areas are rapidly being devoted to this vegetable. When these larger areas are neglected, the natural enemies are soon sure to appear in increasing numbers. So to-day we have an overincreasing number of inquiries of what to do for the asparagus beetle. The advice is—"get rid of them, of course,"—but how? As the leaves of the plants are mostly thread-like and oily, the poisoned spray in order to remain attached to the plants must be applied as the finest mist possible I have found such a finely divided spray, containing lead arsenate, three pounds to fifty gallons of water gave excellent results, cleaning up every last one of the young beetles within twenty-four hours. In plantations where the asparagus is large, the material may be divided by means of a barrel sprayer on a sled. This is drawn through the rows by a horse, and the material is thrown on the plants sideways, through nozzles fixed on two upright pipes at the back of the sled. A man stands on the sled and operates the pump. When the asparagus is small, an arrangement of nozzles and pipes similar to that used for spraying field potatoes, may be used.

In cabbage culture, one of the worst enemies is the green cabbage worm, the parent of which is the white cabbage butterfly. When the plants are young, one of the best remedies is to keep them well sprayed with lead arsenate, using about one ounce to the gallon, applied as a very fine mist. This will stick on, and kill the young

worms as they hatch. Paris green may also be used, and a good method is to apply this as a dry dust spray, one part to one hundred parts, by weight, of flour, put on while the plants are damp. Lime or land plaster may be substituted for flour. As the head of the cabbage forms from the inside and the outer leaves are usually thrown away, there is no danger attached to the use of the arsenical poisons, especially the more easily washed off Paris green, even while the heads are forming. Such a small amount of Paris green is applied in any case that it has been carefully calculated that it would be necessary for a man to eat at one meal forty cabbages containing all the Paris green that was originally applied, in order to have even a slight dose of arsenic. By the rain and weathering, the removal of the outer leaves, the washing before the cooking, and straining, as a matter of fact, it would be impossible for him to get anything but the smallest trace of what was originally applied. Notwithstanding these facts, I do not advocate the use of Paris green on cabbage after the heads begin to form, but much prefer the powdered hellebore or pyretherum, used as a dust spray while the plants are damp.

The Cabbage Root Maggot is sometimes troublesome, and when it occurs, plants may be protected by cutting little circles of tarred paper about six inches in diameter, making a cut with a pair of scissors that would correspond to a radius of their circle, and slipping one of these little cut circles about the base of each plant. The plant would then stand in the center of this paper circle, which would lie flat on the soil surface. These tarred paper circles are not very expensive and if neatly put on are an effective method of protection against the root maggot.

Potato beetles, or more commonly and erroneously called "bugs" are again becoming troublesome. For many years they had been quite scarce, so much so that many persons thought they had disappeared altogether. Our Economic Zoologist, however, several times took occasion to explain that this could not possibly be the case, and prophesied their early return. Suddenly, last year they did appear, in immense numbers, and because not expected, in many instances caused serious losses before the remedy could be applied and take effect. The standard arsenical poisons are the best means to use for this insect. They are applied as a spray, using two pounds of lead arsenate or about twelve ounces of Paris green to fifty gallons of water. In case Paris green is used alone, about two pounds of unslackened lime, or six pounds of slackened lime paste should be added to each barrel of mixture. As a rule, these insecticides when applied to potatoes, should be used in connection with the Bordeaux mixture. The combination will not only give protection against the "bugs," but to a great extent is a preventive against the early and late blights. It also discourages the flea beetles. The yield, even where blights and insects are not in evidence, is often noticeably increased from this spraying. Its proper use is in a large measure equal to an insurance of a potato crop.

**MEMBERS
OF THE
PENNSYLVANIA STATE BOARD OF AGRICULTURE,
FOR THE YEAR 1910.**

MEMBERS EX-OFFICIO.

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APPOINTED BY THE STATE POULTRY ASSOCIATION.

J. D. Nevius, Philadelphia, 1910

**APPOINTED BY THE PENNSYLVANIA BRANCH OF THE AMERICAN
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Term expires

		Term expires.
Clinton,	J. A. Herr,	Millhall, R. F. D., 1911
Columbia,	A. P. Young,	Millville, 1912
Crawford,	J. F. Seavy,	Saegeertown, 1911
Cumberland,		
Dauphin,		
Delaware,	E. J. Durnall,	Swarthmore, 1911
Elk,	John M. Witman,	St. Mary's, 1911
Erie,		
Fayette.		
Forest.		
Franklin,	John P. Young,	Marion, 1911
Fulton,	J. L. Patterson,	McConnelisburg, 1913
Greene,	N. M. Biddle,	Carmichaels, 1913
Huntingdon,	Geo. G. Hutchison,	Warrior's Mark, 1912
Indiana,	S. E. George,	West Lebanon, 1913
Jefferson,	Peter B. Cowan,	Brookville, 1913
Juniata,	Matthew Rodgers,	Mexico, 1912
Lackawanna,	Horace Seamans,	Factorysville, 1913
Lancaster,		
Lawrence,	Sylvester Shaffer,	New Castle, 1913
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Lehigh,	P. S. Fenstermaker,	Allentown, 1912
Luzerne,		
Lycoming,	A. J. Kahler,	Hughesville, 1912
McKean,	O. W. Abbey,	Turtle Point, 1913
Mercer,	W. C. Black,	Mercer, 1911
Mifflin,	M. M. Naginey,	Milroy, 1913
Monroe,	F. S. Brong,	Saylorsburg, 1913
Montgomery,	J. Sexton,	North Wales, 1911
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Northumberland,	I. A. Eschbach,	Milton, R. F. D., 1911
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Pike,		
Potter,		
Schuylkill,	John Shoener,	New Ringgold, 1913
Snyder,		
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Venango,		
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Wayne,	Warren E. Perham,	Pleasant Mount, 1911
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York,	G. F. Barnes,	Rossville, 1911

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J. Newton Glover,	Vicksburg.
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CEREALS AND CEREAL CROPS.

J. Miles Derr, Chairman, Milton.

ROADS AND ROAD LAWS.

H. C. Snavely, Chairman, Cleona.

FRUIT AND FRUIT CULTURE.

D. A. Knuppenburg, Chairman, Lake Carey.

DAIRY AND DAIRY PRODUCTS.

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FERTILIZERS.

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J. L. Patterson, Chairman, McConnellsburg.

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W. Theo. Wittman, Chairman, Allentown.

**PAPERS READ AND ADDRESSES DELIVERED AT THE
THIRTY-THIRD ANNUAL MEETING OF THE PENNSYLVANIA STATE BOARD OF AGRICULTURE, HELD AT HARRISBURG, PA., JANUARY 26 AND 27, 1910.**

REPORT OF THE COMMITTEE ON CEREALS AND CEREAL CROPS.

By A. P. YOUNG, Chairman,

Among cereal crops adapted to our soil and climate, we find corn, wheat and oats holding rank in value in the order named; corn easily standing first because of its extensive use as food for man and beast. Since the advent of the silo, it is possible to preserve the entire plant above the ground in its succulent and palatable form for stock food until it grows again—easily until Spring has awakened the grasses, and, with proper care, may be made to round out the year, or last until the crop is again ready to harvest.

CORN.

Great interest has lately been aroused in the corn crop by corn breeders' associations, corn shows, and seedsmen having seed corn of alleged superior merit for sale. All of these interests are possibly working for the betterment of the crop, and it sadly needs bettering, less than thirty bushels being the average yield, whereas, several times that is possible. Interest in the production of good corn has been growing for years. Selection and care of seed, varieties best adapted to the soil and climate of the particular section, preservation of seed in its best form and testing its germinating power before planting time, have received much attention. Preparation of the soil, fertilizing, time of planting, manner of planting, after care and cultivation, have all come in for consideration and study. It is easy to figure out a yield of corn on paper with rows four feet apart, hills three feet apart in the rows, three stalks in a hill, an ear of corn on each stalk ten inches long with sixteen rows of grains. But go to the field and look around. Perhaps, the first thing to catch the eye will be the frequently missing hills, then in some fields want of uniformity in number of stalks in the hill, one to five perhaps being often found; barren stalks with no sign of an ear, others with only a nubbin and

during thaws in winter to seriously injure, if not entirely destroy its germinating power, if followed by a sharp freeze. If it grows at all, a weak plant is the result and no ear or even a nubbin is the product. The smut problem is somewhat more difficult to combat, but its prevalence can be very much reduced by going over the field carefully, taking out infected stalks, and destroying the germs by burning. This followed up year after year will reduce the loss from this source to a small margin.

Much of the "fuss and feathers" attendant upon testing seed corn may be avoided by proper selection and care of seed. For size and shape of ear and grain the selection can be made as readily when picking out the seed at gathering time as at planting time the next spring. A plot or side of the field may well be set aside from which to select seed. If it be impossible to give the entire field all the attention it should have, this part, at least, should be attended to carefully. Emasculate every barren stalk before it sheds any pollen, remove all smutty growths, no matter on what part of the stalk it occurs, let no weak stalk remain, this followed up year after year will reduce the loss from barrenness, want of vitality and smut, besides adding to the satisfaction of handling the crop.

There is another point in corn growing that is worthy of attention. Don't depend upon getting a first-class crop of corn from seed brought from a distance. Corn to do its best must be acclimated, must become a resident of the place, must have a little time to become acquainted with the soil as well as used to the atmospheric changes of the particular locality before it will do its best. Breeding seed corn is receiving great attention in some localities and it certainly promises well for America's most important cereal. Good seed well cared for from gathering to seeding time will start the crop toward a satisfactory harvest.

The Bureau of Statistics of the United States Department of Agriculture finds in its preliminary estimate of the average yield per acre 26.2 bushels. Compare this with one hundred bushels and more, which is possible, and we realize that a majority of corn growers must be raising very poor corn.

Columbus, on landing upon the soil of the Western Hemisphere—if we credit history—found corn growing with all the chief characteristics that mark it today, the leading if not the only cereal known to the dusky aborigines. Selection, improved cultivation and care has doubtless increased varieties as well as yield to some extent. The Department further gives us a comparison of yields, showing a little advance; 26.2 bushels in 1908, 25.9 bushels in 1907, 25.6 bushels for last ten years. Verily, improvement is slow, but we of Pennsylvania can congratulate ourselves upon producing more corn per acre than the great corn states of the Middle West—that we hear so much about as being the greatest corn field in the world, with what they some years ago boastingly claimed as their inexhaustible soils where they burned up and threw manures into the creek, in order to be rid of them. They, too, have come to realize the truth of Poor Richard's maxim—"Always taking out of the meal tub and never putting in will reach the bottom." Well illustrated in the course of the Western corn crop, for while they have not reached the bottom entirely—thanks to the ordering of Divine Providence—which makes it impossible to entirely exhaust the soil, nevertheless, the average yield is below the point of profitable production.

Nothwithstanding corn has been introduced wherever civilization has extended, nowhere has it found a more congenial soil than in the land of its nativity. About seventy-five per cent. of the world's production is credited to this country. The ingenuity of our people have found many ways to utilize the crop. In the Paris Exposition of 1900, there was exhibited a museum case containing more than one hundred separate commercial products manufactured from corn, and development in this direction still continues. Our breakfast food manufacturers in their eagerness to get something new on the market do not stop at breakfast, but produce dinner and supper foods as well. It is fitting that corn should occupy the center of the stage in this country. It is *Native American*.

WHEAT.

Unlike corn, wheat it not a native American grain. But it has been found to be wonderfully well adapted to our soil and climate, and the only reason why the yield falls below that of some of the older European countries, is the want of care in preparation, fertilization and cultivation. Like corn, the form and filling out of the ear has much to do with the yield. Ears of wheat pointed at both ends are not usually large producers of uniformly plump kernels, like the pointed ear of corn, the grains are quite apt to be small at the tip. One average yield is entirely too small, due primarily to want of care in selecting and caring for seed and carelessness or ignorance in preparing and fertilizing the seed bed. Wheat rapidly exhausts the soil of elements necessary for its best development. It is much more impatient than corn of improper treatment. Corn may continue to yield fair crops for several years from the same piece of ground, but wheat soon tires and must have more care in rotation, preparation of soil and more careful and intelligent management. Wheat is important from a commercial point of view. It readily lends itself to transportation, either as grain flour or finished products. The wheat and flour of this country have been a potent factor for years in relieving distress and saving lives in other lands.

OATS.

Of oats, the other cereal chosen to have attention briefly in this report, we can say that it seems to be less adapted to our soil and climate than either wheat or corn. Yet fitting into a rotation as it does, well adapted to our conditions and again its great value as a feed grain, it being a better balanced ration for the horse than any other grain we produce, makes it important. Being better adapted to the colder North countries seems to require that we renew its vitality frequently by getting seed from the more congenial climes.

With a paragraph emphasizing the need of bringing about better conditions of producing and caring for the best possible seed and its dissemination, we will close this report.

We hear much of technical schools and the importance of special training is certainly not overestimated. At this time when the school question is so prominently before us, may we not enter a plea for more specific Agricultural Education in rural schools.

Since the advent of the Township High School we hear something of teaching agriculture. Town schools are searching about for vacant

lots to utilize in imparting instruction practically in Nature Study, the growth of plants. They want to teach agriculture..

Now, when this school question is finally threshed out, may we not have provision for a farm school, wherever in the rural districts sufficient pupils can be got together to warrant a veritable farm school with farm and stock and all the paraphernalia necessary to make intelligible, not only the theory but the practice as well, where the boys and girls can get hold with their hands of all the jobs that must be done about the farm and household. Not as depicted by Charles Dickens in his satire upon doings in his day. He depicted it in this way, using a somewhat vulgar setting:

“Oh mother may I go out to swim?
Why yes, my dearest daughter:
But hang your clothes on the hickory limb,
And don’t go near the water.”

The propagation and dissemination of improved varieties, with proper care, would add much to the production of every township. Let the school farm take up this work under competent instruction—let it be an experiment station—a dissemination of information of all kinds valuable to the neighborhood—theory and practice, not theory alone. Let us of the rural districts push for better things in the country. We have been going to town too long for education. They teach in the town the arts of the town, let us teach in the country the arts that are appropriate to the country.

REPORT OF THE COMMITTEE ON FEEDING STUFFS.

By G. G. HUTCHISON, Chairman.

To the Members of the State Board of Agriculture:—As your representative and specialist under the Feeding Stuffs Control of the Department of Agriculture, I beg leave to make the following report of our work for the year that has just closed:

This has been a very busy year in our Bureau. As stated to you a year ago at your meeting, the Feeding Stuffs Law was then before the Court of Lehigh county and was being tested on its constitutionality on the question of the preference given to the millers of Pennsylvania in regard to the sale of bran and middlings at the place of manufacture. Judge Bechtel decided that that portion of the law was unconstitutional.

Anticipating this decision, we prepared a new Feeding Stuffs Law and eliminated that clause that referred to the sale of bran and middlings where manufactured. This law is now upon the statute books and it is the one which we are working under at this time. You have all been furnished with copies of it and are no doubt familiar with its requirements.

THE NEW LAW.

The new law, as it passed the House, was a very drastic measure, in some particulars, as it prohibited the mixing of oat hulls, corn cobs, weed seeds, rice hulls, peanut hulls and similar substances with any feed that was sold or offered for sale in Pennsylvania. The bill passed the House as originally prepared, but when it came to the Senate, the manufacturers of feeds that used oat hulls and corn cobs as a mixture with their feeds, requesting a hearing, and after a number of hearings, in which both sides were represented, the bill was finally passed, allowing the mixing of oat hulls with feed, but not in an amount to exceed nine per centum of fiber. The bill also allows the mixing of corn cob with corn products, but not in amount to exceed nine per centum of fiber and they cannot be mixed with any other feed and sold. It also allows the grinding of whole corn without being shelled or with other grains.

The law also places bran and middlings under the same heading as whole grains. Whole grains can be ground either separately or mixed together and do not need to have the percentage of protein, fat or fiber. Bran and middlings can also be sold when pure without the placing of the analysis on same. There has been a great deal of controversy in regard to the placing of analysis on brans. They vary from two to three per cent. in protein in some samples. This caused a great deal of hardship and controversy among the dealers.

The feature in the new law that will be the greatest benefit to the farmers and feeders of domestic animals in Pennsylvania, is the one that prohibits the mixing of weed seeds, rice hulls and peanut hulls with feeds. Weed seeds was one of the mixtures that was used very extensively by the manufacturers of molasses feeds according to our reports and those of Vermont and Maine Experiment Stations. These seeds were not digestible except when fed to chickens or sheep; hence, all that were fed to other domestic animals were not assimilated and were worthless. As soon as the law was put into effect, which was the first of August, 1909, the majority of the manufacturers of molasses feeds stopped mixing weed seeds with other feeds that were shipped into Pennsylvania. They were known to the trade as wheat screenings, and this was misleading. Wheat screenings, as recognized by the Department, are small grains of wheat or broken grains of wheat, not weed seeds. So much for the adulterants.

BY-PRODUCTS.

Now comes a vital question in regard to feeds, and that is the by-products that are found upon the markets of our State. These by-products are very valuable and there is a great demand for them among our feeders. I wish to state that I am not opposed to the feeds that are manufactured from the by-products if they are sold for what they are and sold for the amount of protein and fat which they contain, and a true statement giving the amount of fibre and also their composition. This gives the purchaser plain notice of what he is buying. The fibre-content of feed has a great deal to do with the availability of the protein-contents, and feeders should educate themselves to understand that a feed which is high in fibre is not as digestible a feed as one which is low in fibre; or in other words a feed which is high in fibre has not as much of its protein available as one that is low in fibre.

ANNUAL REPORT OF THE

Off. Doc.

TABULATED STATEMENT.

Name of County.	Town or City Visited.	Number samples collected in each town or city.	Number samples collected in each county.
Adams, -----	Gettysburg, -----	8	
	Littlestown, -----	None taken.	
Allegheny, -----	Pittsburg, -----	5	8
	McKeesport, -----	6	
	Braddock, -----	7	
	Carnegie, -----	4	
	Duquesne, -----	None taken.	
	Wilmerding, -----	None taken.	
Armstrong, -----	Homestead, -----	None taken.	22
	Apollo, -----	4	
	Leechburg, -----	3	
	Freeport, -----	4	
	Kittanning, -----	7	
	Ford City, -----	2	
Beaver, -----	Parker's Landing, -----	None taken.	20
	Beaver Falls, -----	10	
	New Brighton, -----	3	
	Beaver, -----	4	
	West Bridgewater, -----	4	
	Rochester, -----	None taken.	
Bedford, -----	Monaca, -----	None taken.	21
	Freedom, -----	None taken.	
	Six Mile Run, -----	4	
	Hopewell, -----	1	
	Everett, -----	5	
	Bedford, -----	6	
	Coaldale, -----	None taken.	
Berks, -----	Hyndman, -----	None taken.	
	Saxton, -----	None taken.	16
	Reading, -----	23	
	Kutztown, -----	3	
	Fleetwood, -----	4	
	Birdsboro, -----	None taken.	
	Douglassville, -----	3	
Blair, -----	Boyertown, -----	None taken.	28
	Altoona, -----	41	
	Juniata, -----	5	
	Hollidaysburg, -----	2	
	Martinsburg, -----	6	
	Roaring Springs, -----	1	
Bradford, -----	Tyrone, -----	2	
	Bellwood, -----	None taken.	
	Duncansville, -----	None taken.	
	Gaysport, -----	None taken.	
	Williamsburg, -----	None taken.	57
	Troy, -----	8	
Bucks, -----	Canton, -----	8	
	Towanda, -----	8	
	Athens, -----	4	
	Sayre, -----	None taken.	23
Butler, -----	Doylestown, -----	9	
	Chalfont, -----	4	
	Coimarr, -----	4	
	Quakertown, -----	4	21
	Butler, -----	14	
	Mars, -----	1	
	Valencia, -----	1	
	Evans City, -----	1	
	Harmony, -----	2	
Cambria, -----	Zelienople, -----	2	20
	Cresson, -----	2	
	Gallitzin, -----	1	

TABULATED STATEMENT—Continued.

Name of County.	Town or City Visited.	Number samples collected in each town or city.	Number samples collected in each county.
Cameron,	Emporium, -----	8	
	Driftwood, -----	None taken.	
Carbon,	East Mauch Chunk, -----	5	8
	Mauch Chunk, -----	None taken.	
	Lansford, -----	2	
	Lehighton, -----	3	
	Weisport, -----	3	
	Slatington, -----	3	
Centre,	Philipsburg, -----	11	13
	Bellefonte, -----	4	
	State College, -----	4	
	Centre Hall, -----	None taken.	
	Howard, -----	None taken.	
	Milesburg, -----	None taken.	
Chester,	Coatesville, -----	7	19
	Parkesburg, -----	4	
	Pomeroy, -----	None taken.	
	Modena, -----	2	
	Mortonville, -----	2	
	Downingtown, -----	7	
	West Chester, -----	12	
	Phoenixville, -----	8	
	Frazer, -----	None taken.	
	Kennett Square, -----	8	
	West Grove, -----	4	
	Avondale, -----	None taken.	
	Paoli, -----	8	
Clarion,	East Brady, -----	3	22
	New Bethlehem, -----	2	
	Clarion, -----	5	
	Knox, -----	None taken.	
Clearfield,	Du Bois, -----	5	10
	Oescoila Mills, -----	3	
	Wallaceton, -----	1	
	Clearfield, -----	4	
	Coalport, -----	None taken.	
	Curwensville, -----	None taken.	
	Houtzdale, -----	None taken.	
	Irvona, -----	None taken.	
	Mahaffey, -----	None taken.	
	Ramey, -----	None taken.	
	McKees Gap, -----	None taken.	
	La Jose, -----	None taken.	
	Morrisdale, -----	None taken.	
	Munson, -----	None taken.	
	Woodland, -----	None taken.	
Clinton,	Lock Haven, -----	2	13
	Mill Hall, -----	None taken.	
	Renovo, -----	None taken.	
Columbia,	Flemington, -----	3	14
	Bloomsburg, -----	8	
	Catawissa, -----	3	
Crawford,	Berwick, -----	9	22
	Titusville, -----	5	
	Cochranport, -----	7	
	Saegertown, -----	1	
Cumberland,	Meadville, -----	3	16
	Shippensburg, -----	5	
	Carlisle, -----	2	
	Newville, -----	6	
	Mechanicsburg, -----	22	
Dauphin,	Harrisburg, -----	6	
	Middletown, -----	None taken.	

TABULATED STATEMENT—Continued.

Name of County.	Town or City Visited.	Number samples collected in each town or city.	Number samples collected in each county.
Elk, -----	Ridgeway, -----	8	
	St. Marys, -----	4	
	Johnsonburg, -----	4	
Erie, -----	Corry, -----	4	
	Union City, -----	1	
	Erie, -----	19	
Fayette, -----	Waterford, -----	None taken.	
	Uniontown, -----	6	24
	Belle Vernon, -----	None taken.	
	Connellsville, -----	None taken.	
Forest, -----	Dunbar, -----	None taken.	
Franklin, -----	Tionesta, -----	6	6
	Waynesboro, -----	5	
	Greencastle, -----	None taken.	
Fulton, -----	Chambersburg, -----	8	
	Waterfall, -----	4	
	Dublin Mills, -----	None taken.	
Greene, -----	Gracey, -----	None taken.	
Huntingdon, -----	Waynesburg, -----	6	6
	Petersburg, -----	4	
	Alexandria, -----	4	
	Huntingdon, -----	3	
	Mt. Union, -----	5	
	Mapleton, -----	4	
	Three Springs, -----	3	
Indiana, -----	Orbisonia, -----	4	23
	Saltsburg, -----	6	
	Blairsville, -----	5	
	Blacklick, -----	3	
	Homer, -----	3	
	Indiana, -----	5	
	Olymer, -----	3	
Jefferson, -----	Ernest, -----	None taken.	23
	Punxsutawney, -----	7	
	Lindsey, -----	2	
	Big Run, -----	1	
	Reynoldsville, -----	3	
	Brockwayville, -----	4	
	Brookville, -----	7	
Juniata, -----	Summersville, -----	None taken.	24
	Mifflin, -----	3	
	Port Royal, -----	None taken.	
Lackawanna, -----	Thompsonstown, -----	None taken.	3
	Scranton, -----	22	
	Carbondale, -----	None taken.	
Lancaster, -----	Dunmore, -----	None taken.	23
	Lancaster, -----	48	
	Lititz, -----	14	
	Columbia, -----	8	
	Manheim, -----	13	
	Rheems, -----	4	
	Elizabethtown, -----	7	
	Ephrata, -----	None taken.	
	New Holland, -----	None taken.	
	Mt. Joy, -----	None taken.	
	Florin, -----	None taken.	
	Marietta, -----	None taken.	
	New Creek, -----	"	89

TABULATED STATEMENT—Continued.

TABULATED STATEMENT—Continued.

Name of County.	Town or City Visited.	Number samples collected in each town or city.	Number samples collected in each county.
Tioga, -----	Forest City, -----	6	17
	Hallstead, -----	None taken.	
	Susquehanna, -----	None taken.	
	Westfield, -----	2	
	Wellsboro, -----	12	
	Manafeld, -----	8	
Union, -----	Blossburg, -----	4	26
	Lawrenceville, -----	None taken.	
	Lewisburg, -----	5	
	Mifflinburg, -----	5	
	Vicksburg, -----	None taken.	
	Emlenton, -----	1	
Venango, -----	Oil City, -----	7	10
	Franklin, -----	3	
	Utica, -----	None taken.	
	Warren, -----	2	
	Youngsville, -----	2	
	Clarendon, -----	None taken.	
Warren, -----	Tidloute, -----	None taken.	11
	Sheffield, -----	None taken.	
	Washington, -----	17	
	Canonsburg, -----	8	
	Huston, -----	None taken.	
	Honesdale, -----	11	
Washington, -----	Hawley, -----	None taken.	4
	Derry, -----	4	
	Latrobe, -----	4	
	Greensburg, -----	8	
	Manor, -----	3	
	Irwin, -----	4	
Wayne, -----	Mt. Pleasant, -----	5	25
	Scottsdale, -----	7	
	Jeannette, -----	None taken.	
	Monessen, -----	None taken.	
	New Kensington, -----	3	
	Penn, -----	None taken.	
Westmoreland, -----	Vandergrift, -----	5	46
	Parnassus, -----	3	
	Tunkhannock, -----	8	
	Meshoppen, -----	8	
	North Mehoopany, -----	8	
	Mehoopany, -----	None taken.	
Wyoming, -----	York, -----	35	19
	Red Lion, -----	4	
	Hanover, -----	8	
	Wrightsville, -----	None taken.	

A bulletin will soon be published giving the analysis of each sample for protein, fat and fiber and the composition of the feeds and all other information that the law directs to be given.

SAMPLES ANALYZED FOR INDIVIDUALS.

There have also been received by the Chief Chemist 322 samples sent in by citizens of our Commonwealth to have analyzed for their own information. As you understand, this is done as provided for by law; but a charge of one dollar is exacted from the parties sending in a sample. This fee is deposited in the State Treasury for the benefit of the State at large and none of it is available for the use of the laboratory. Some may question why this fee of one dollar is charged to our citizens. The reason is that it would put a check on the number of samples that would be sent in and not take up the

time of the chemist that should be devoted to other work, but this does not begin to cover the cost. You can see that this gives you the number of samples of feeding stuffs which have been analyzed, making 1,629.

In analyzing feeds for our citizens it gives them an opportunity to keep a check on the dealers from whom they purchase feed. I would call your attention to one or two cases which come to my mind at this time. A number of farmers, members of a certain Grange in Lancaster county, purchased a carload of cottonseed meal. They discovered that there was some cottonseed hulls or something that resembled them mixed with their meal. They drew a sample, sent it to the Department with one dollar enclosed, had it analyzed and found that they had bought cottonseed meal that did not come up to the amount of the guarantee, and the Chemist gave them the amount that they had paid the jobber, but did not receive value for. They called his attention to the matter and the jobber refunded them \$25.00. Another case in the same guarantee where the matter was taken up in a similar manner, a sample was analyzed and the jobber refunded \$22.50. I call your attention to these cases to show how purchasers of feed could protect themselves, and I believe in a short time feed then would be sold on its analysis of protein, fat and fiber.

In the months of April and May of last year, there was shipped into this State a large amount of wheat bran and wheat middlings. These shipments were made from Buffalo, N. Y. It was adulterated with ground corn cobs and the amount was 40 to 50 per cent. We secured samples in McKean, Potter, Tioga, Bradford, Lycoming, Elk and Cameron counties. We brought suit on all of these cases and the mixer or compounder of these feeds in Buffalo paid fines to the dealers amounting to over one thousand dollars. This was a dear lesson to the manufacturer in Buffalo, but it was also dear feed to the farmers where it was sold. These corn cobs were ground as fine as middlings and could not be detected except by analysis. The jobber paid the fine, but who will refund the money to the men who paid and fed the feed?

A word of caution in regard to men in high positions in agriculture making statements in regard to feed.

I will call your attention to one case. Hon. James Wilson, Secretary of Agriculture, gave out a letter, under date of November 14, 1904, saying "he would rather have a pound of dried beet pulp to feed to a dairy cow than a pound of corn, and I would rather have it in many cases where the object is the make of fat, solely."

The Secretary is mistaken or the Chemist must be. We will take the analysis of two samples of dried beet pulp in 1907. Protein, 8.85 per cent., Fat, 0.79 per cent., Fiber, 19.08 per cent., four samples in 1908, Protein, 9.56 per cent., Fat, 0.92 per cent., Fiber, 19.40 per cent.

Corn meal or corn chop analyses:

Protein 10.50 per cent., Fat 5.02 per cent., Fiber 2.20 per cent.

Why do we find corn higher in Protein by 2 per cent., higher in Fat by over 4 per cent. and lower in Fiber by 17 per cent.?

This statement has mislead farmers all over the United States in buying beet pulp. I do not condemn beet pulp, but I do say it is not as valuable as pure corn for feed, and a farmer is making a mistake that pays as much for it as beet pulp.

The following table will explain at a glance how we have endeavored to show the chief cereals and seeds together with the products gotten from the miller and those gotten from different manufacturing processes in which grains are used.

We have also tabulated the different by-products which are used as adulterants, some adulterated feeds and all miscellaneous products used in or obtained from manufacturing processes.

Specimens of all these products will be found in the exhibit together with a collection of the common drugs used in condimental foods and we have also added a collection of wheat and corn from different countries, the analysis of which we hope to have at some later time.

You will also find samples of different mixed feeds and molasses feeds which have been on or are on the market. These specimens show the composition, together with their analysis.

Grains or Seeds.	Mill Products.	By-Products from Mill Used for Feeding Pur- poses.	By-Products Used as Adulterants.	Adulterated Feeds.	Miscellaneous Products.
Alfalfa, Barley, Buckwheat, Corn,	Alfalfa meal. Bran. Shorts, middlings, flour; Cracked corn, corn meal, red corn bran.	Malt sprouts, brewers' grains, Hulls and middlings, Distillers' grains, gluten feed, hominy feeds, white corn bran, corn oil cake, refuse from Kellogg's Toasted Corn Flakes.	Hulls, Cleanings from corn, mostly cob. Screenings from corn, mostly cob. Ground corn cob.	Brewers' grains with rice hulls.	Corn oil, corn germ, col- oring matter used for coloring gluten feed.
Wheat, Oats, Cottonseed,	Graham flour, middlings, shorts, bran. Flaked oats, hulled oats, bran. Ground cottonseed,	Oat hulls.	Wheat middlings with corn cobs.	Linseed oil meal and flax screenings.	Feeds containing varying quantities of hulls and meal. Linseed oil.
Flaxseed, Rice,	Ground flaxseed, Bran, polish,	Cottonseed hulls. Cottonseed bran.	Flax screenings and flax plant refuse. Hulls,	Brewers' grains with rice hulls, molasses feed with rice hulls.	
Peanut, Rye,	Meal,		Bran and ground hulls.		
	Flour, middlings.				

Miscellaneous Materials Used for Feeding Purposes.	Used as Adulterants.
Meat meal.	Cocoa hulls.
Dried sugar beet.	
Distillery slop.	
Hay.	
Straw.	
Spelt.	
Locust bean meal.	
Granulated milk.	
Salt.	
Seeds.	
Grits.	
Bone.	

COLLECTION OF FEEDS.

I would like to call your attention to our collection of feeds that is here displayed for your benefit. They have been gathered together in our laboratory as an educational exhibit, where you can see the different products of feed which are derived from the different cereals. We had it at State College during Grange Week. We were more than pleased at the interest that was taken in it by the farmers. Part of the time it took three men busy answering questions and explaining the different materials. We have here over 150 samples. We would be pleased to explain to you the exhibit.

IMPROVEMENT IN QUALITY OF FEEDS.

There has been a marked improvement in the quality of feed coming into our State. What shows this better than anything is the number of prosecutions which have been brought by direction of the Secretary of Agriculture in the following counties:

Allegheny,	2
Armstrong,	1
Blair,	3
Bradford,	2
Butler,	1
Clarion,	1
Cumberland	1
Delaware,	1
Erie,	3
Elk,	4
Huntingdon,	1
Lackawanna,	3
Lancaster,	1
Lawrence,	1
Luzerne,	1
McKean,	4
Lycoming,	1
Mercer,	1
Monroe,	3
Northumberland,	2
Philadelphia,	3
Potter,	6
Tioga,	8
Westmoreland,	1
York,	2

In all the prosecutions that were brought the past year before aldermen and courts, we were successful in securing conviction and fines in all the cases but one and in that case, the cost was imposed upon the defendant.

Last year there were 128 prosecutions. This shows that there is a better condition existing than there was last year, and I would say that the largest number of these prosecutions were made against the Buffalo party who flooded our State with adulterated wheat bran and wheat middlings. The interpretation that the Department places upon the law is that it is not for the means of securing revenue, but it is for the protection of purchasers of concentrated and commercial feeds to give them the full value of their money at the fair market price.

Friends, this is one of the most important subjects that comes before a meeting of this kind. It represents large sums of money to you and to all, and our endeavor is to keep the markets as clean of adulterated feed as possible. I want to thank you all for the aid you gave us last winter in the passage of the new law and of the work you did to have the bill a law. What we need is more money to employ more men to visit dealers and manufacturers and to secure samples oftener. We ought to call on each dealer or manufacturer four times a year, and in this way keep in touch with the trade.

BUREAU OF CHEMISTRY.

Our laboratory is situated on the fifth floor of the Capitol Building. The following is a list of the chemists, general agent and special agents, also clerk and stenographer:

James W. Kellogg, B. Sc., Chief Chemist.

John S. Spicer, B. Sc. First Assistant Chemist.

George L. Walters, B. Sc., Second Assistant Chemist.

Malcolm H. Ulman, B. Sc., Third Assistant Chemist.

Franklin Menges, Ph. D., Special Assistant Chemist.

Elmer C. Gildroy, Ph. C., Special Assistant Chemist.

W. Earl Huber, Laboratory Assistant.

L. Pearl Gustin, Stenographer and Clerk.

Geo. G. Hutchison, General Agent.

John F. St. Clair, Special Agent.

W. John Stiteler, Special Agent. (Paris Green and Linseed Oil.)

Prof. Menges is employed on Paris Green work.

Mr. Gildroy is employed by the Dairy and Food Commissioner.

Our Chief Chemist and his corps of assistants would be glad to see any of you and show you their workshop. We have now in preparation a new bulletin giving the work done in 1909, and we will send each one of you a copy, but we would be pleased for each member of this Board to send in a list of names. These names will be placed on our mailing list and kept there for future bulletins.

As a recognition of the good work we have been doing during the past years, the Federal Government offered our former Chief Chemist, Mr. F. D. Fuller, a position with them in an effort to carry out the provisions of the National Pure Food and Drug Law, which also covers the commercial feeding stuffs sold throughout the United States. Mr. Fuller severed his connections with this Department on April 1, 1909, and was succeeded by the First Assistant, J. W. Kellogg, who is now the present incumbent.

I want to make special mention at this time of the efficient work that has been done by Special Agent, John F. St. Clair. Mr. St. Clair has devoted his best energies to the work of securing samples throughout the Commonwealth and has proved very efficient in the position he occupies.

I also want to return thanks for the courtesies received from the Secretary of Agriculture and the confidence that he has placed in me as his representative in this work.

I wish also to acknowledge the courtesy and kind words that have been spoken by the agricultural press as well as trade journals that represent the different feeding and milling interests in this State and other states. I also take this opportunity of expressing my thanks to the press of Pennsylvania for their able assistance and their endeavor to keep the importance of this question before the public. I also wish to return my thanks to the different agricultural organizations throughout Pennsylvania for their assistance in our work.

REPORT OF THE COMMITTEE ON WOOL AND TEXTILE FIBRES.

By D. S. TAYLOR, Chairman.

The wool industry of the world is not so great as in former years. The production of wool has decreased in many of the wool-producing sections of the world, and increased in a few—North America, Asia, and Africa, producing more, South America, Europe, Australia and New Zealand producing less. North America, Asia and Africa produced 47,725 pounds more wool in 1906 than in 1903. South America, Europe, Australia and New Zealand produced 108,193 pounds less wool in 1906 than in 1903, showing a loss in production of wool in the world in 1906 of 60,460 pounds.

In 1907, we had in the United States 53,241,282 head of sheep, valued at \$204,210,129; in 1908, 54,631,000 sheep valued at \$211,736,000, an increase in numbers of 1,389,718, and in value of \$7,525,871 in one year. Pennsylvania had on April 1, 1908, 950,000 sheep of shearing age—average weight of fleece 6 pounds—producing 5,700,000 pounds wool washed and unwashed. The average price in the Philadelphia market in 1908, was 32c, showing the value of the wool crop of Pennsylvania in 1908 to be \$1,924,000. We find the shrinkage in scouring Pennsylvania wool to be 48 per cent., West Virginia, 48 per cent., and Ohio, 49 per cent. The average weight of fleece—Pennsylvania, 6 pounds, West Virginia, 5½ pounds, and Ohio 6½ pounds.

In 1907, the United States imported 188,305,955 pounds of wool. In 1908, we imported 125,980,524 pounds, or 62,325,431 pounds less in 1908 than 1907. The wool production of the United States in 1908 was 311,138,321 pounds—imported in 1908, 125,980,524 pounds showing 437,118,845 pounds of wool for the American factories.

On April 1, 1908, Pennsylvania had 950,000 sheep of shearing age, producing 5,700,000 pounds of wool washed and unwashed, producing 2,960,000 pounds of scoured wool. Ohio on the same date had

2,000,000 sheep of shearing age, producing 13,000,000 pounds of wool washed and unwashed, and producing 6,630,000 pounds of scoured wool. West Virginia had on the same date 950,000 sheep of shearing age, producing 5,700,000 pounds of wool washed and unwashed, and producing 2,960,000 pounds of scoured wool.

The damage to livestock in Washington county, Pennsylvania, from dogs, in 1908, was \$4,906.30; of this amount \$4,418.87 was paid for loss of sheep; for dog tags, \$55.00; serving notices \$10.60, and for killing dogs \$88.50. Since 1906 the average amount paid yearly in Washington county for damage to livestock, by dogs, has been \$4,702.74; and I am informed by the Chief Clerk of our County Commissioners, that the unpaid claims filed in their office was about \$4,000 more than the fund for this purpose was on January 1, 1910.

The wool industry of Pennsylvania appears to be increasing. From 1905 to 1908, the production was increased 600,000 pounds, or 200,000 pounds per year. In 1909, the price of wool increased about 3c per pound, and much of the product was sold while yet on the sheep's back, and offers of last year's prices are now being made to some of our Washington county wool growers, for wool to be shorn in May and June of 1910.

But the cost of producing wool is more now than a few years ago, when we count the increased value of our lands for taxable purposes, the cost of labor and feed. But with all, we think there is more profit in wool and sheep production now than in some other branches of livestock husbandry. We know that the growing of sheep and wool by the land owner is better because it is better for his land, in keeping his land in better condition, distributing the rich droppings from the sheep while on pasture more evenly and on the highest parts of the pasture, as the sheep select the highest part for resting at night. And the permanent pasture and all fields on which sheep are kept have better sets of grass roots than those fields on which cattle are kept. The sheep will eat the young sprouts from land which has been recently cleared from timber, and will keep down weeds, briars, etc., which cattle and other stock will not. And the sheep in going over our land do not tramp the soil so deep and hard as heavier animals. And we know our soil, climate and other conditions which we have in Western Pennsylvania, Eastern Ohio and West Virginia are such, that in this section we can produce a better grade of fine wool than has yet been produced in any other section of the United States.

REPORT OF THE BOTANIST.

By PROF. W. A. BUCKHOUT, State College, Pa.

The year 1909 has not materially differed from those preceding in respect to botanical inquiries from farmers, nor in any matter concerning economic plants. History here, as elsewhere, but repeats itself. Hence I shall but briefly summarize a few matters which seem to me of particular interest and value, and will bear repeating.

1. The necessity for good seed in farm and garden cropping is as imperative as ever.

To determine good seed is a prime requisite. Various samples have been submitted to me. Reply has tried to emphasize two points: (1) A germination test should be made in order to show the percentage of living seeds, capable of growing quickly and vigorously when placed under the germinating influences. This takes some few days or weeks to determine. (2) Careful examination of a sample will show the percentage of seed true to name and also of foul seed or dirt with which it may be adulterated. Since the foul seeds are apt to be of weeds it is also desirable to know their names and the probable amount of injury which they may cause if they are allowed to grow and get a foothold. For general purposes and in many instances this can be done in a few hours.

Correspondence discloses so great ignorance of these matters that I feel warranted in again calling attention to them and urging increased and more continuous alertness on the part of farmers in the selection and use of seed.

Owing to the large use of clover and alfalfa and the wide range of source of these smaller farm seeds, they are much more frequently submitted for examination than any others. Dodder, Russian thistle and Bur-grass have been the most injurious of the accidental adulterations. The last mentioned is easily detected because of its large size and prickly character; hence it is not common. The other two being smaller are both more difficult to detect and more difficult to remove. This is where the need of seed examination comes in. Any one who sows dodder infested seed must expect more or less dodder in his fields. Fortunately it is not a particularly difficult weed to eradicate, but it takes time and labor; these are valuable commodities and no prudent man chooses to waste them.

Of the purposed adulterations of seeds, I am glad to say no cases have come to my attention. It is fair to assume that they are becoming less frequent owing to the vigorous measures which are controlling trade in seeds and food products of all kinds. The farmer may well congratulate himself on this, but let him not relax his own vigilance. His own ignorance and inattention are still loop holes through which he is defrauded. There is no sharp line of separation between accidental and purposed seed adulteration. Careless and indifferent dealers will sell impure seed as long as they find purchasers.

Red clover and Alfalfa are particularly liable to contain weed seeds. Dodder sometimes makes ten or more per cent. in the uncleared seed. Unless this is pretty carefully screened out it is easy to forecast the result,—A dodder infested crop even though every other condition is perfect. Cleaning is a tedious process, but there is no escape from it.

2. On the general subject of weed destruction, inquiries still come in large numbers and with provoking frequency. Provoking, I say, because the inquirer so commonly seems to infer that his weed experience is something new and also that there must be some quick, short-hand means of exterminating weeds at little cost and trouble. Neither is true. While new weeds occasionally appear, it is rare; and the practical difficulties are such as are encountered on hundreds of farms. Sometimes it will pay to dig out and destroy individual weeds: generally it will not. Sometimes weeds can be destroyed by spraying with copperas, generally, in our district, that is impractical.

ble. Generally, successful weed destruction means two things: First: thorough plowing and cultivation with hoed crops; second, following this up after two or three years by seeding to grass or grain. The more thorough the cultivation and the more careful the seeding, the more likelihood of getting rid of the weeds. Seeding should always be heavy and the ground should be liberally manured. The object throughout is to weaken the weeds by frequent cultivation and then choke them out by the more vigorous growth of some useful plants.

Simple as this appears any practical man knows that it means work, and work intelligently done. Nevertheless it is perfectly feasible and is, moreover, the only practicable method in the majority of cases.

Minor details in the process will vary according to circumstances in each case, but the general principles are the same in all. The most troublesome cases are such as garlic where the weed chiefly depends on its tubers for continuance, or the great seed producing weeds like thistles and wild carrot, which your easy going neighbors and indifferent road supervisors allow to flourish, apparently for the express purpose of seeding your fields and nullifying your care and labor.

Much interest still prevails in so-called special crops and the gullible public, ever on the lookout for some quick way of making money, is easily duped. I refer particularly to such plants as ginseng, golden seal and other drugs. It is indisputable that these wild plants can be successfully cultivated and that they are somewhat improved and the crop increased under cultivation, but they are so different from ordinary farm and garden crops and required such nicety of care and attention that they are in a special class by themselves. It is idle to talk of growing them by the acre and handling them as one would celery or corn.

The popular accounts of profit derived from these crops are generally founded upon very small gardens which yielded at the rate of so much per acre. The fallacy of this method of computation should be obvious to every intelligent man. Sales from such gardens are, moreover, generally of seeds and small roots for replanting. The prices of this stock are generally disproportionately high so long as the interest of the purchasers can be bolstered up.

If any one desires to engage in this cultivation he should thoroughly inform himself before hand regarding all the details of planting and management. The dealers, of course, will be only too glad to give him this information. But if he is wise he will seek the advice of disinterested parties. I know nothing better than Bulletin No. 27 of our own State Department of Agriculture "The Cultivation of American Ginseng in Pennsylvania," by Professor George C. Butz, if it is still in print.* A similar bulletin, No. 16, Division of Botany, U. S. Department of Agriculture, covers much the same ground. It can be had of the Superintendent of Documents, Washington, D. C., for a few cents.

I cannot too strongly recommend and urge our farmers and cultivators of all sorts to acquaint themselves with the public literature on various topics connected with their business. I find very few people have any idea of the activities of the U. S. Department of Agriculture and the range of its publications. There are few subjects which have not received attention and study from its experts and upon which they have not written in clear and concise directions. Much of this is

available to any applicant. The series of Farmers' Bulletins now numbers over three hundred and fifty. While some of the earlier ones are out of print all the others can be had gratis on application. A small charge is made for bulletins of other series, but it is so small as to be insignificant compared with the completeness and value of their information. No one can keep fully abreast of the times without being familiar with these documents.

In conclusion, I wish again to offer the facilities of the Botanical Department of the Pennsylvania State College to any who wish information on botanical and nearly allied points. We seem to be on the eve of a more intelligent and intensive agriculture. Toward this your Agricultural College ought to be able to offer a very helpful hand.

REPORT OF THE CHEMIST.

By DR. WILLIAM FRRAR, *State College, Pa.*

RELATIONS OF FERTILIZERS TO ROOT DEVELOPMENT.

In talking about plant production in its various phases, we rarely take the whole plant into consideration. Our thoughts are confined to the yield of grain or fruit, or at most to the aerial parts of the plant. Only in the case of root or tuber crops do we give attention to the subterraneous part of the crop, and even then it is upon the marketable fraction of this part that we dwell. Yet we all realize clearly that unless there be a satisfactory development of the root system and a proper performance of its functions, whereby especially the moisture and mineral food supplies of the soil are brought into the plant, we can not rationally hope for a proper development of the stalk and grain or fruit.

All who have weeded a garden, or thinned a corn crop, know something about the root systems of plants, and have more or less definite ideas upon the subject of their development and of certain major differences that plants of different families exhibit in these particulars. Few who have pulled weeds have failed to distinguish between plants that form thick tap roots and those that branch out near the surface of the soil into a clump of fibrous branches, the multiple roots. Most would recognize in these two classes the two groups of deep and shallow rooted plants.

Those who have observed more closely have noted that the surfaces of the thicker, older roots are coated with a dense, corky outer layer;

thirty root washing experiments, compiled by the writer, show that in the eastern part of the United States the weight of the dry matter of the roots and short stubble varies from one-third to one-half that of the top of the plant; or in other words, that of the entire weight of dry matter in the mature crop, one-fourth to one-third goes to form the root system, in the case of grain crops and grasses.

Most cultivators have observed that in the case of very young plants the growth of the root is more rapid than that of the top; but the notions on this subject are usually too vague to be expressed in figures. During the past few decades a number of investigators have studied the matter upon crops or field growth. In general, the results obtained accord quite fairly with those gained, some years ago, by the writer in such study of the growth of the corn crop. The plants grown from kernels planted two inches deep in a rich loamy soil, had, at the end of two weeks, 178 pounds of roots for each 100 pounds of top; at the end of four weeks, after two weeks further development of both roots and tops, there were only 42 pounds of roots for each 100 pounds of top; or, in other words, during the second two weeks of growth the proportion of root top had fallen to one-fourth of that found at the end of the first two weeks; or, in still different terms, at the close of the second week there was for each four pounds of top, a root system of seven pounds to gather food and drink for it; at the end of the fourth week, a root system of only 1.6 pounds for like service. What fraction of the total root system was in condition for such service at the two periods named, has, so far as I know, never been ascertained.

Again, it is a matter of common observation that plant roots go far in search, as it is usually expressed, for water and mineral food when these are located at points remote from the place where the seed was planted; whereas, if a body of plant food, such as a bone or a lump of manure, be found near at hand, the roots will mass themselves densely about the object without forming any widely extended system pervading the entire weed-bed; and will in that case be short and fleshy, rather than long and slender as they are when they stretch out toward a remote food or water supply.

Further, those who have studied, by means of water cultures, the behavior of plants as they are deprived of one or another of the materials commonly supplied as foods by the soil, have noted very striking variations in the character of the root systems developed by the same plant under conditions identical with the exception of the absence of one or another food element. For example, the roots of a healthy, sprouted corn kernel show, when dipping into a complete culture solution containing a suitable amount of nitrogen and of the several essential mineral foods, a slightly branched system of stout, yellowish roots of no great length; but when dipping into a solution equal in volume to the former and like it in all respects save that lime compounds are absent, form a widely extended, highly branched system of very slender, intensely white roots. These observations have led, nevertheless, to few suggestions of importance to the practical farmer.

Quite recently, however, several studies have been made upon the influence of fertilizers upon root development that merit the attention of the crop grower, more because they throw light upon the action of fertilizers than because they have, as yet, been made the basis of

new rules of practice. It is to one of these, reported some months ago from the Agricultural Experiment Station, at Darmstadt, Germany, by Max Wagner, that your attention is especially invited, and more particularly to those of its results that exhibit the effects of fertilizers upon the quantities of roots and tops developed by the several crops tested,—oats, barley, mustard and buckwheat.

The crops were grown in pots, upon a soil of coarse texture, well supplied with lime, but quite deficient in nitrogen, potash, and phosphoric acid. Water was added at the outset in favorable quantity, which was maintained by daily additions sufficient to make up for the losses by evaporation from soil and crop. Of the fertilizers used, the phosphoric acid and parts of the potash and nitrogen were thoroughly mixed with the soil at the outstart, a top dressing of the remaining potash and nitrogen being given later. The quantities given were normal for such experiments. At the conclusion of the period of growth, the tops were cut off close to the ground, dried, weighed, and analyzed; the roots were carefully washed out, and likewise dried, weighed, and analyzed. From the analyses and weighings it was found that the mature plants of each of the crops, except the buckwheat, had taken up practically all of the potash and nitrogen supplied respectively in the form of potash salts and nitrates, while but half of the phosphoric acid added in superphosphate and Thomas slag (basic slag) had been taken up.

The yields in grams of dry matter in the tops and roots of the several mature crops differently fertilized, are shown in the following table; and also the ratio of dry root to dry top, the latter being taken as 100:

Crop and Treatment.	Top.	Root.	Ratio.
Oats.			
Unfertilized,	18.65	10.87	58
Complete fertilizer,	158.41	55.70	35
Complete fertilizer, without phosphoric acid,	109.88	34.56	31
Complete fertilizer, without potash,	110.90	44.66	40
Complete fertilizer, without nitrogen,	17.03	9.21	54
Barley.			
Unfertilized,	9.95	8.60	86
Complete fertilizer,	151.74	58.40	38
Complete fertilizer, without phosphoric acid,	94.18	37.43	40
Complete fertilizer, without potash,	76.50	28.75	38
Complete fertilizer, without nitrogen,	14.43	10.20	71
Mustard.			
Unfertilized,	11.53	4.44	39
Complete fertilizer,	100.30	21.14	21
Complete fertilizer, without phosphoric acid,	81.91	15.21	19
Complete fertilizer, without potash,	75.74	11.48	15
Complete fertilizer, without nitrogen,	11.40	3.60	32
Buckwheat.			
Unfertilized,	18.28	3.85	26
Complete fertilizer,	127.95	19.00	15
Complete fertilizer, without phosphoric acid,	87.20	15.85	18
Complete fertilizer, without potash,	110.75	18.20	16
Complete fertilizer, without nitrogen,	7.88	2.28	29

These results show that, although the phosphoric acid and potash were both helpful to crop increase, the vital deficiency was that of nitrogen. They further show that lack of nitrogen, whether be-

cause no fertilizer at all was given or because only a non-nitrogenous fertilizer was used, led a relatively large root development as compared with that of the top. Wagner noted that in the absence of nitrogen, the root mass was large and composed of long fibers, whereas, when the nourishment was sufficient, there was formed a relatively short, compact root net. He infers, therefore, that the consequence of abundant fertilization is, within certain limits, more economical than that from small applications, because the former produces relatively more top.

This law of economy, he says, controls the formation of plant organs in favor of the development of the fruit,—the maintenance of the species. When food is abundant in the soil, the plant spends little building material upon the root, to save it for the top. The roots are only secondary nutritive organs; they have the duty of seeking out the raw materials, taking them up and transferring them to the leaves. If this labor of the roots is rendered easy by the presence of abundant soil nutriment, it is not needful to extend these organs so far, the building material is saved, and is productively used in the stronger upbuilding of the more important nutritive organs proper, the assimilation apparatus.

In view of this fact it may be said, that it is rational to provide the plant so abundantly with nutritive salts that it may develop normally, that is, so as to employ most of the available nutriment for the formation of the productive organs proper, the foliage, and to use correspondingly less of it for the formation of roots.

Wagner notes that plants are able, in some measure, to readjust quickly their ratio of root to top as surrounding food conditions may require, and thus to survive a change in such conditions; also that some plants can effect this readjustment more readily and fully than others, and that such are most fit to survive and experience the widest distribution upon different soils. Finally, he notes that a difference in the root to top ratios may be fixed by heredity under a particular environment and that thus the several varieties of the same species may come to exhibit distinctly different powers of survival under adverse conditions, such as Atterburg noted in the case of various barley races growing upon soils deficient in potash.

It is possibly unwise to generalize too broadly upon the basis of so limited a volume of data. We may safely note, however, that these experiments raise many questions of practical importance relative to the control of plant development by the use of fertilizers, the production of varieties suited to particular environments, and the residual effects of various systems of fertilization upon the composition of the soil, more particularly with reference to the amount and distribution of its humus and of the associated soil bacteria.

REPORT OF THE SANITARIAN.

By DR. H. D. MOORE, *New Lexington, Pa.*

Since the passage of the Act of the General Assembly of 1905 creating a Department of Health, and the subsequent appointment of a Commissioner of Health, with authority to issue rules and orders for the betterment of the health of the people, and power to enforce these rules and orders, and since the work of the Department, under the guidance of the Commissioner of Health, has been conducted so wisely and systematically, and has progressed so rapidly, the public in general, and the people of the agricultural districts in particular, have learned more than ever before in regard to sanitation, and how to avoid contagious diseases and care for those who fall under their power.

While the medical practitioners in the rural districts, were not oblivious to the unsanitary conditions in their fields of practice, the advice that certain things should be done to improve the sanitary conditions in, and around the home, was seldom heeded; but when the local health officer, under instructions from the Commissioner of Health appears upon the scene, with the "you must do it" order, there is no alternative but to obey. This relates more particularly to the pollution of streams. Until quite recently the popular idea was that the most important use of the streams was to carry away waste matter from cities, towns and the farm, and that the air and sunlight, and sand over which the water passed would soon purify them, which is more or less true.

The farm is a minature municipality in itself, with the farmer as mayor or burgess, and filling all the other offices of a municipality himself, excepting that of boss, in case he has a wife. As a rule, the agriculturist is not only a working man, but also a reading man, observing, and quick to take up new ideas not only relating to agriculture, but anything pertaining to the health and welfare of his family. The time has long since passed, when a case of sickness in the family is regarded as a Providential affliction.

In a case of sickness now, the first questions arising are, what is the cause, or from whence the infection? With the aid of the family physician these are sought and removed as far as possible, and if necessary, the Commissioner of Health sends his agents to assist.

When we compare the modern houses with the old farm houses, in which many of us were brought up, we wonder that we are here. The house was located below the spring, the walls were laid in mortar made of clay and water, which the rats cleaned out in a few years. A large water trough in which to cool milk was put across one side of the cellar, and boards laid loosely on cross pieces for a floor, which, as a result of scrubbing and water underneath, soon filled up to the boards with a muck that "squashed" through the crevices every

time they were stepped upon. The redeeming feature of these houses was, that they were without plaster or paper lining, and having no weather strips at doors and windows, plenty of fresh air found its way into the living rooms. Later, lime and sand replaced clay mortar, and at the present time cement is used almost exclusively and the custom of having running water pass through the cellar, has been, to a great extent abolished.

A dry site is selected for the new farm house, cement and concrete are used for the foundation, with the view of having the cellar as dry and clean as any other part of the house. Where the old farm house has undergone repairs and remodeling, the old board floors in the cellars have been removed and replaced with concrete, the walls plastered with cement, making them absolutely vermin and water proof, and in place of the old wooden trough there is a small one built of cement.

All over the rural districts, springs are being walled in with cement, and all precautions taken to keep surface, or "wild water"—as it is often called—out of them. The spring-house or milk-house is built in the same careful manner. The stone walls in old dug wells are being replaced with tiling, concreted on the outside from solid rock to the surface. The drill is taking the place of the pick and shovel for making new wells, which are cased from surface to solid rock. Cities and towns no longer can boast of their more convenient water supply in their houses. The farmer being his own self appointed engineer looks over his grounds, and if there is a never-failing spring on the hillside, elevated higher than the house, the water is piped to the house and barn; or if such a supply does not exist, water is forced into the house by windmill, or gasoline engine, or even by hand power and hot and cold water, with the bathrooms and lavatories are installed all through the house.

By the humble agriculturist of the past these conveniences were considered luxuries, only to be enjoyed by city and town folk, and the wealthy farmer, who either had more money than he knew what to do with, or wanted to imitate the city ways. These things are no longer considered luxuries, but necessities, and we find them in the rural districts all over the State.

One of the first principals of perfect sanitation is to "clean out, clean up and keep clean." But we can't do these things without plenty of water, pure clean water, for both man and beast; and where this is not naturally supplied, the drill will reach it.

The Commissioner of Health has started in at the very fountain head of our water supply, and removed all sources of contamination of the waters, over a great part of the State, and the work will be continued until the surroundings of every farm building are inspected, and everything unsanitary corrected. With very few exceptions the farmer is ready to obey any of the instructions from the health officer. Since it has been demonstrated to be a fact, that, cows drinking water infected with typhoid fever germs, may convey these gems to persons using their milk and this fact has become known throughout the rural districts, when the farmer hears of a case of typhoid fever at the headwaters of a stream from which his cows drink, he is as much interested in the place, where contamination of the waters might occur, as though it were on his own farm.

The printed instructions, issued by the Commissioner of Health, and put in every house where a contagious or infectious disease occurs, has not only been a great aid to physicians, but is educating the layman to his part in the elimination and prevention of disease, not only in his own household, but also, that of his neighbor.

There is much to consider in regard to the dust and smoke nuisance. We of the southwestern part of the State can no longer boast of the pure ozone laden air in the hills and mountains, the air being laden with the smoke and dust from smoke stacks and coke ovens. In my own section, with two ranges of mountains intervening, everything outdoors is blackened more or less. We do not even have white snow. This condition exists over hundreds of square miles of territory. It is easily explained why the water from the melting snow tastes like carbolic acid.

The dust from the public roads is another nuisance which should be abated. This dust has always been a menace, in seasons of long drouth, to farmers living along public highways, and since the introduction of the automobile it has been multiplied many times. A fair sized automobile can, and does, "kick up" more dust than a "20-mule borax team" or a drove of sheep.

It has been a query to me, why people who are apparently thoughtful in everything else pertaining to sanitation and hygiene, will tour over the country roads for days and weeks, in the dry season of the year, inhaling a dust which in itself is unwholesome, and may contain disease germs from both man and beast. The remedy is dustless roads, and it is gratifying to note that they are being made so, by the application of mineral oils, in many parts of the country, notably in the far West.

The vacuum house-sweeper, a modern invention, which, considered from a sanitary point of view, will be a great help in cleaning the house of dirt and dust, when it can be put on the market at a price low enough to enable it, to find its way into every home.

One of the most unsanitary things we have to contend with is the common house fly. It has been demonstrated beyond dispute that the house fly has carried the germs of diseases from one person to others, and from house to house. Gulliver in his travels, when he arrived in the land of the giants, and found the house fly there, as large as a meadow-lark, was probably the first man to discover what a filthy and obnoxious insect it is. In years gone by, the house fly was considered a scavenger, and essential to sanitation. We remember the time, half a century ago, when farmers wives dried most of their fruit by cutting it in quarters, (schnitz) then putting them on strings and hanging them above the stove to dry. These strings of fruit were veritable fly roosts. This dried fruit was exchanged at the country store for city goods. It was then shipped to the cities where it was consumed. There is probably where we made our escape. We were saved by some one else eating the fruit. At meal time we gently lifted the fly out of the jelly or syrup dish, and watched it wiping its

The fly is said to be short lived. But who ever saw the dead body of a fly that died a natural death. I am sure I never did. The natural breeding place of the house fly is in and about the horse stable. And here is where the eggs and larva can be destroyed by the application of any of the coal tar and creosote disinfectants on the market. These applications must be made about every third day and kept up during the entire summer.

IMPROVEMENTS OF MEADOWS AND PASTURES.

By DR THOMAS F. HUNT, *State College, Pa.*

The Flemish had a proverb: No grass, no cattle; no cattle, no manure; no manure, no crops.

What these lowland farmers of Europe meant was that good grass is the basis of good agriculture. We are not without illustration in this country, as, for example, the famous blue grass region of Kentucky. Every practical farmer knows that if he has a good, heavy sod to plow up he may reasonably expect, other things being equal, to secure a good crop of corn, while if his meadow is allowed to run out the chance of a successful crop is very much lessened.

It has been the custom to apply yard manure to land for corn and to use commercial fertilizers for wheat, but the value of the fertilizers, particularly commercial fertilizers, in increasing the growth of grass and thereby building up the fertility of the soil has not been generally understood. It is true that some farmers do top dress their meadows with yard manure and this is a good practice but very few have applied commercial fertilizers to their grass lands. After some years of investigation of this subject I believe it safe to assert that the same money used in applying commercial fertilizers to grass lands will bring a greater profit when applied for corn or wheat. Of more importance, however, is the fact that while obtaining this greater profit the land is made more productive for succeeding crops. This does not mean that fertilizers may not be used to advantage for either corn or wheat, but merely that a still greater profit results when applied to grass lands.

This paper has only one purpose. It is to demonstrate so clearly and forcibly that the above statements are true that land owners will be induced to act upon them.

In the address on "Soil Fertility" delivered before the last meeting of the Pennsylvania State Board of Agriculture, the speaker touched briefly upon the importance of clover in keeping up the fertility of the soil. It is desired to develop a little more in detail the lesson of these fertilizer experiments at the Pennsylvania Station with reference to the influence of common red clover. Those who listened to the address of last year or who have read the bulletins of the Pennsylvania Station know that these fertilizer experiments which have

been in progress twenty-eight years consist of four tiers, each containing thirty-six eighth acre plats. The four tiers represent a complete four year rotation of corn, oats, wheat and hay (clover and timothy). The fertilizers are applied to the corn and wheat only thus being applied on alternate years or twice in the rotation.

It so happens that there are five plats on each tier receiving no fertilizers of any sort while there are four which have received only mineral fertilizers consisting of 48 pounds of phosphoric acid, equivalent to 320 pounds of 15 per cent. dissolved bone black or dissolved rock phosphate and 100 pounds of potash equivalent to 200 pounds of muriate of potash, 80 per cent. purity. The following table shows the average yield of the seven products of the rotation during the last five years of the first twenty-five years, where there was no fertilizer and where mineral fertilizers were applied. These years have been chosen because the conditions probably more nearly represent the comparative results to be obtained on run down limestone soil:

AVERAGE FIVE YEARS, 1902-6.

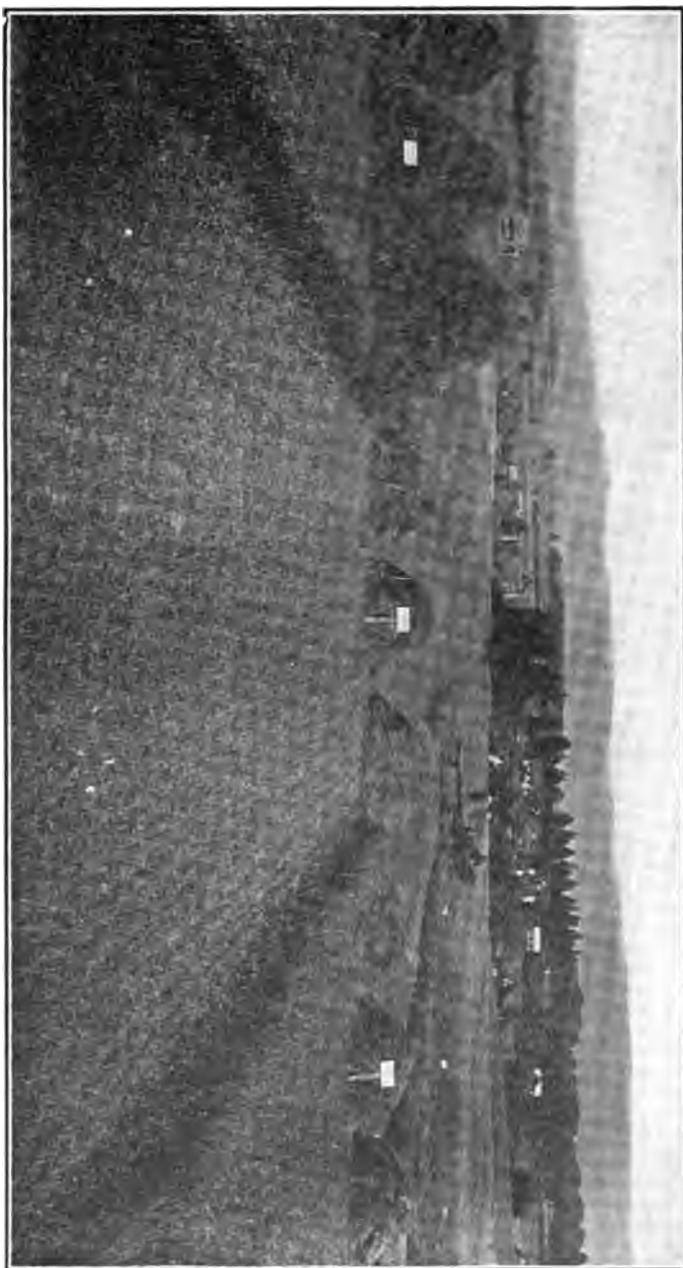
	No treatment. 5 plats.	Phosphoric acid 48. Potash 100. 4 plats.
Corn, ears, bu.,	35.6	51.4
Corn, stover, lb.,	1,711	2,086
Oats, grain, bu.,	23.4	34.4
Oats, straw, lb.,	1,110	1,098
Wheat, grain, bu.,	10.5	19.8
Wheat, straw, lb.,	816	1,027
Hay, lb.,	2,329	4,460

During the last five years, 1902-1906, in place of 36 bushels of corn where no fertilizer was applied, 51 bushels were grown where mineral fertilizers only were used. There were 34 bushels of oats in place of 23 bushels, 20 bushels of wheat in place of 10½, and nearly 2½ tons of hay in place of a little more than a ton. This was done at an annual cost of \$3.20 per year; but if we are correct in believing that the application of potash was excessive and could be reduced one-half, then the result would be obtained at an annual cost for fertilizer of \$2.20.

This photograph shows the hay raised this year (1909) on plats 13, 14 and 15 of tier 3. Below is shown the treatment, as follows:

Treatment.	Yield.
Plat 13 Plaster, 230lb.,	1,408
Plat 14 No treatment,	1,216
Plat 15 P 48, K 100,	4,496

FIG. 2.—Plates 13, 14 and 16.



Plat 14 has received no fertilizer in twenty-eight years, while plat 15 has received the mineral fertilizers every other year. The first plat yielded at the rate of a little over half a ton of hay, while the latter produced at the rate of nearly $2\frac{1}{4}$ tons. It will also be observed that but little result was obtained from the application of 320 pounds of land plaster. The principal reason for introducing this photograph, however, is merely to impress my hearers with the fact that these were actual results obtained from real land.

The purpose of calling attention sharply to the results obtained from the use of these mineral fertilizers, phosphoric acid and potash, is not for the purpose of pointing out their value in keeping up the fertility of the soil so much as it is to call attention to the vast importance of clover and other leguminous crops in supplying the nitrogen. Nitrogen is absolutely necessary to growing crops. It usually is the first element to be exhausted from the soil. It is the most expensive element to replace, costing about 20 cents a pound as compared to five cents for phosphoric acid and four cents for potash.

The three principal methods for keeping up the nitrogen supply of the soil open to the average farmer are (1) by raising clover or other leguminous crops, (2) by carefully saving through the use of proper bedding the liquid excrement of animals, since it is the liquid excrement that contains most of the nitrogen, and (3) by buying nitrogen in commercial fertilizers at twenty cents a pound for the nitrogen contained. All three ways are good in their place. It is safe to say, however, that the farmer who raises staple farm crops and does not have a systematic rotation in which clover or some other leguminous crop enters is slowly going into bankruptcy.

But, it may be said, I cannot raise clover any more. It must be admitted that there is a vast area, more than ten million acres in New York, Pennsylvania and Ohio known as the Volusia series of soils on which in recent years great difficulty has been found in raising red clover. The distribution of this series of soils is shown roughly on this map. It so happens that the speaker lived for some years on the edge of this area and studied the soil conditions with considerable care. Some experiments were planned and carried out by Cornell Station in order to determine, if possible, why clover failed so completely on certain of these soil types, especially that type known as the Volusia silt loam.

A careful study of all the probable factors influencing the growth of red clover was made. Among other things experiments were made to determine the influence of lime, yard manure and commercial fertilizers in producing red clover. One of these trials was conducted on a loam soil at Cherry Creek, Chautauqua county, New York, described as a once fertile farm that had become so poor that the former owner had lost it. The following table shows the method of treatment and the results obtained during 1908. The mammoth clover was sown in oats the previous year. To avoid misunderstanding, it should be stated that other results, not given here, indicated that common red clover was to be preferred to mammoth clover.

YIELD OF MAMMOTH CLOVER IN 1908 AT CHERRY CREEK, CHAUTAUQUA COUNTY, NEW YORK.

No. Plats.	Treatment.	Unlimed.	Limed.
5	Nothing,	1,824	3,862
1	P. K.	2,349	4,174
1	P. K. N.	2,285	4,086
1	15 tons manure,	2,001	4,976

P = Acid phosphate, 100.
 K = Muriate of potash, 50.
 N = Nitrate of soda, 100.

Here the most important result was obtained by liming and here the best results were obtained by both manure and lime. Where there was a combination of manure and lime $2\frac{1}{2}$ tons of hay were obtained in place of a ton without treatment. Not only was the yield of hay increased but the character was changed. Although only mammoth clover was sown, on the unlimed plats the principal grass growing with the clover was redtop, while on the limed plats the redtop was replaced in part by timothy which made a strong growth.

In another experiment made in Tomkins county where the soil type, Volusia silt loam, was much less productive, yard manure gave much less favorable results. The unlimed and unfertilized area yielded 1,015 pounds of hay; the limed area without fertilizers, 1,612 pounds of hay; the limed area which received mineral fertilizers yielded 1,929 pounds of hay; while the limed area which received yard manure yielded only 1,555 pounds of hay. In other words, the stable manure caused an apparent decrease in yield. This second experiment, however, in no way detracts from the lesson to be derived from the Chautauqua county experiment. It merely shows that other conditions exist to prevent the manure becoming effective. In this particular instance it was probably due to the manure emphasizing the effect of the severe drouth.

Any land which, when sown to clover and timothy, produces in their stead chiefly redtop and sorrel (*Rumex acetoselo*), will be benefited by the use of lime. Apply anywhere from 1,000 to 4,000 pounds or from 15 to 50 bushels. In the opinion of the speaker it does not matter greatly how much is applied, when it is applied, or what kind is applied. The chief thing is to get finely divided lime into the soil. Ordinarily it may be applied on top of plowed land when it is being prepared for corn. One may buy recently burned quick lime and allow it to slake in piles, or buy slaked or hydrated lime or ground or pulverized limestone provided it is ground finely enough. It should be remembered, however, that it takes about 1,350 pounds of hydrated lime and about 1,800 pounds of pulverized limestone to furnish as much actual lime as 1,000 pounds of pure quick lime.

There is one lesson, however, that every land owner should not forget, namely, that while lime with manure will increase the yield the continued use of lime without manure may decrease it. Lime cannot take the place of fertilizers nor can fertilizers take the place of lime. Here is a photograph of three plats showing the yield of timothy and clover from tier 3 of our fertilizer series.

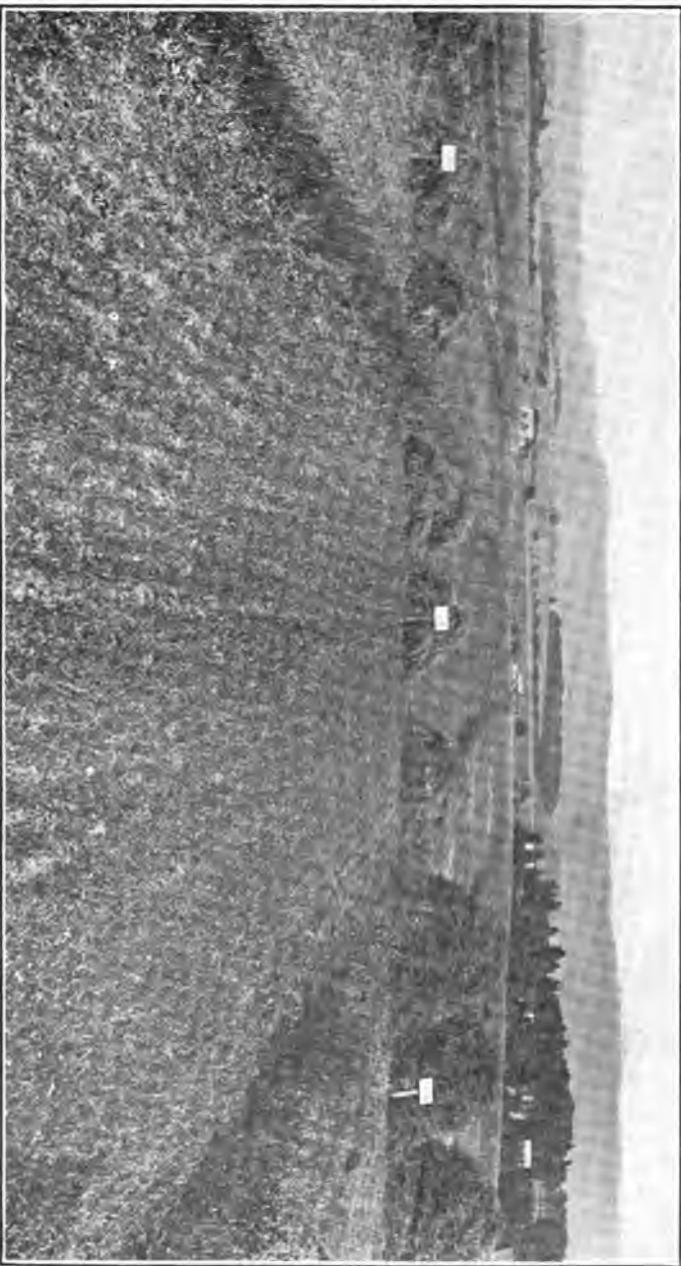


Fig. 3.—Plates 22, 23 and 24.

No. plat.	Treatment.	Yield of hay, 1900. Lb.	Yield all products, 1882-1906.
22	Manure, 6 tons, -----	5,784	18,416
22	Lime, 2 tons, -----	1,880	11,682
24	Lime, 2 tons, -----	1,040	11,668
16	No treatment, -----	4,008	17,353
	Manure, 6 tons, -----		

Plat 22 has had six tons of manure once in two years and two tons of quick lime once in four years.

Plat 23 has received the lime the same as plat 22, but has not been manured, while plat 24 has had nothing done to it during the past twenty-eight years. Another plat (plat 16) not shown in this picture has received the same amount of manure as plat 23 but has not received any lime.

Having demonstrated the importance of clover or other legume in maintaining the supply of nitrogen and having emphasized the importance of lime where needed in maintaining a good stand of clover, the next step is to demonstrate the importance of commercial fertilizers in maintaining meadows. In 1903 the Cornell Station began the study of timothy from a great variety of standpoints. Among the experiments started was one to determine the influence of fertilizers in increasing the yield of pure timothy hay. A piece of well worn but not exceedingly fertile land known as Dunkirk clay was used. It was the intention to seed the timothy in 1903 with wheat. The land was prepared and fertilized that fall but rains set in and prevented sowing the wheat. Oats and timothy were, therefore, sown in the spring of 1904. The chart shows the actual average yield per acre of timothy hay obtained from the different plats during 1905, 1906 and 1907.

AVERAGE ACTUAL YIELD OF TIMOTHY HAY PER ACRE DURING 1905, 1906 AND 1907.

No. of Plats.	Treatment.	Weight, Lb.
8	Nothing, -----	2,901
1	P, -----	4,283
1	K, -----	4,490
1	N, -----	4,580
1	P, N, -----	4,707
1	P, K, -----	4,127
1	K, N, -----	5,127
6	K, N, P, -----	6,615
1	10 tons manure, -----	5,093
1	20 tons manure, -----	7,298

Commercial fertilizers were applied in the fall of 1903 as previously stated and directly to the timothy in the spring of 1905, 1906 and 1907, just as the grass was starting. Stable manure, however, was applied only in the fall of 1903 and in the fall of 1906. In the latter case, of course, as a top dressing. The average of eight nothing plats during three years shows a yield of timothy hay of about $1\frac{1}{2}$ tons. The yield obtained from plats treated with commercial fertilizers varied from two to over three tons per acre, while the plats receiving yard manure varied from $2\frac{1}{2}$ to $3\frac{1}{2}$ tons. In order to show the effect of the fertilizers more distinctly this chart has been prepared.

TIMOTHY HAY ON DUNKIRK CLAY AT CORNELL UNIVERSITY, AVERAGE RESULTS 1905, 1906, 1907.

	Apparent increase in yield, lb.	Net annual gain due to fertilizers 4 years.
N.	1,211	\$1 71
P.	689	1 18
K.	988	2 03
N. P.	1,614	1 91
N. K.	2,082	4 55
P. K.	1,079	1 85
N. P. K.	2,632	5 46
10 tons manure,	2,975	9 87
20 tons manure,	5,175	14 60

N = 160, nitrate of soda.
 P = 320, acid phosphate.
 K = 80, muriate of potash.

Note that N stands for 160 pounds of nitrate of soda equal to 25 pounds of nitrogen, P for 320 pounds of acid phosphate equal to 50 pounds of phosphoric acid, and K for 80 pounds of muriate of potash equal to 40 pounds of potash. The manure has been estimated in this table at one dollar a ton or load. The first column shows the apparent increase in yield due to the treatment, that is to say, it shows how much greater than yield was then on adjacent unfertilized plats.

The yield of oats in the year 1904 is not shown in this chart.

a ton the manure was worth \$2.18 a ton or load when ten tons were applied and \$1.94 when twenty tons were applied. As the experiment progresses the smaller application of manure becomes relatively more valuable per ton of manure applied. In general terms a ton or load of manure produced about two dollars worth of hay when the latter is worth \$10 per ton.

This experiment emphasizes the readiness with which timothy responds to fertilizers of any kind in this humid climate. Almost any good tillable land in Pennsylvania can be made to yield from two to three tons of hay per acre in an ordinary season. In 1908 the Pennsylvania Experiment Station weighed twenty-four tons of well cured hay from 5 2-3 acres. The previous year certain portions of this same area yielded at the rate of 5 tons and 189 pounds of hay per acre, although the weight of the whole field was not determined in that year. In 1908 the Experiment Station had two fields in timothy and clover. From one field of nine acres 42 loads of hay were obtained, from another field of exactly the same soil type eight loads of hay were obtained from twenty acres. The first had been well farmed, the second had not.

The whole story of the timothy meadow experiment has not been told. The most important part of the story is yet to follow. The purpose of this experiment was not primarily to determine the direct value of commercial fertilizers in increasing the yield of timothy hay but to determine whether the fundamental principle underlying the old Flemish proverb was sound, namely, that good grass was essential to a good agriculture.

After these plats were in timothy for three years they were plowed up and planted to corn without the addition of any fertilizer whatever in order to determine the residual effect of the fertilizers on the subsequent crop. These results have not yet been published, but Professor J. A. Bizzell of the Cornell Experiment Station has furnished me the detailed results in which it is shown that the eight plats which during the previous years had received no fertilizer gave an average yield of 30.4 bushels of corn per acre, while the six plats which had received a complete fertilizer gave an average yield of 56.8 bushels or a gain of 26.4 bushels, while the two plats which twice in the previous four years had had two applications of stable manure gave an average yield of 67½ bushels, or a gain of 37.1 bushels per acre. A handsome profit had already been made from the use of commercial fertilizer and the stable manure. The gains, therefore, represent almost clear profit since the only additional cost was that of harvesting the increased yield. This is taking no account of the increased yield of stover which was nearly, although not quite, as marked as that of the grain.

Even to the hardened investigator these results come almost as a revelation. It is all so simple. All that was done was to apply broadcast by hand at the right time from one-tenth to one-fifth of an ounce per square foot a commercial fertilizer containing the proper proportion of nitrogen, phosphoric acid and potash. If, however, the results which have been given are to be duplicated the greatest care must be taken to have the conditions and methods correct. To obtain the best results, three things are essential: (1) there must be a proper stand of grass, (2) the fertilizers must be applied at the right time, (3) the fertilizer must be of the proper character.

One reason why good results are obtained by the use of commercial fertilizers on grass land is due to the fact that there are so many plants to the acre and that the soil is so full of plant roots ready to make the fullest use of fertilizers applied. It is highly important also that the plants growing upon the land shall be the right kinds. Not only will the wrong plants or weeds reduce the quality of the hay but they usually reduce the yield because generally they will not produce the same weight as would the timothy or clover which they displace. Where, therefore, the meadows have run out and a poor stand of grass remains, the land should be plowed, limed if needed, and put into a systematic rotation. There will then be a stand of grass that it pays to maintain by the use of commercial fertilizers. As an illustration a trial made at the Pennsylvania Station during 1909 may be mentioned.

The Pennsylvania State College has recently added a run down farm of 200 acres to its holdings. A certain twenty acre field which was in wheat when purchased was this year in grass, mostly timothy. The land was too poor to obtain a good catch of clover, although an abundance of seed was sown. Even the timothy was a poor stand. From 11.7 acres of this plat six loads of hay were obtained. These loads were not weighed but if we estimate them at 1,700 pounds each 875 pounds of hay per acre is obtained. On the remaining $8\frac{1}{2}$ acres on April 5, 1909, just as the grass began to grow, commercial fertilizers were applied at the following rate per acre: Acid phosphate 150 pounds, muriate of potash 50 pounds, sodium nitrate 150 pounds. From this $8\frac{1}{2}$ acres eleven loads of hay were obtained while from the 11.7 acres unfertilized but six loads were obtained. If the loads are again estimated at 1,700 pounds per acre the yield in place of being 875 pounds per acre was 2,200 pounds per acre. The cost of the fertilizer not including the cost of application was \$5.57 per acre or about \$8.40 per ton of hay. While this is a fairly satisfactory result it is not what it should have been because of the poor stand of grass.

The second important consideration is the time of application of the fertilizer. It is very important that the commercial fertilizer should be applied just when the grass begins to start in the spring. The station is of the opinion that a delay of even a week at this time may seriously interfere with the effectiveness of the fertilizer. In order to get the best yield of hay, it is essential to get a good, strong growth during the cool, moist portion of the season. It is during this time that we have the least productive soluble nitrates in the soil and hence doubtless the nitrate of soda supplies the necessary nitrogen in the right form for the plants.

Third, in order to get the best results with commercial fertilizers on grass lands it is necessary to apply a commercial fertilizer con-

There is time for only a word about pastures. While quantitative results have not been obtained, it has been abundantly shown that pastures may be improved by the application of either natural or commercial fertilizers. Where pastures are heavily grazed and the animals fed little or no other food, usually they gradually decline. If, however, the cattle are fed considerable concentrated food, especially of a highly nitrogenous character, or if the pastures are top dressed with manure or commercial fertilizers they may steadily grow better. An occasional application of seed, the clipping of the weeds and the harrowing of the fields will also contribute to this end.

The one lesson above all others that the Pennsylvania Station desires to teach, is that soil cannot be made fertile economically at a single stroke, and that land can only be kept up to its highest productive capacity by a carefully and wisely ordered system of cropping, cultivation and fertilization.

In the address made a year ago the speaker suggested as a means to that end a five course rotation that might meet the needs of many farmers. The rotation recommended was corn, oats, wheat, each one year, and timothy and clover two years. On a limestone soil the following fertilization was suggested: For corn, six tons of manure per acre; for oats, no fertilizers except when beginning to build up the soil, in which case 150 pounds of acid phosphate was recommended. For the wheat apply 350 pounds of acid phosphate and 100 pounds of muriate of potash. No fertilizer was recommended for the first crop of hay, for the second crop an application of six tons of yard manure applied the previous summer or fall and if yard manure is not available the application in the spring just as the grass begins to start of commercial fertilizer just recommended for grass lands.

Another rotation is here suggested, not because it is any better than the one previously recommended, but merely to show the possibilities of building up the soil through the application of commercial fertilizers to grass lands.

A SEVEN COURSE ROTATION; MERELY A SUGGESTION.

Year.	Crop.	Fertilizer.	Amount.
1	Corn, -----	Yard manure, -----	6 tons.
2	Corn, -----	Yard manure, -----	6 tons.
3	Oats, -----	Nothing.	
4	Wheat, -----	{ Acid phosphate, ----- Muriate of potash, -----	350 pounds. 100 pounds.
5	Clover and timothy, -----	Nothing.	
6	Timothy, -----	{ Nitrate of soda, ----- Acid phosphate, ----- Muriate of potash, -----	150 pounds. 150 pounds. 50 pounds.
7	Timothy, -----	{ Nitrate of soda, ----- Acid phosphate, ----- Muriate of potash, -----	150 pounds. 150 pounds. 50 pounds.

Modifications of this rotation will occur to every practical farmer. The purpose here is to indicate the application of our present knowledge of the means of maintaining soil fertility to actual farming conditions and to emphasize the importance of some system if the best results are obtainable.

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PAST, PRESENT AND FUTURE OF AGRICULTURE.

By N. F. BARTLEY, Bucld, Pa.

Mr. Chairman, Ladies and Gentlemen: I sincerely wish that one of greater ability had been selected for the duty imposed upon me, for I feel that, while cheerfully responding to the duty, I know that I can but feebly express my thoughts. I came here to learn—I came here as a student, and I do not feel that I have the power to advance ideas in comparison with those who have been on the platform for years. But we find in the good book, "Let every one be subject to the powers that be;" and since the powers that be have asked me to come before you and advance some ideas upon some agricultural subject, but did not assign any one in particular, I, therefore, have chosen a topic that will give me plenty of latitude.

Past, Present and Future of Agriculture—When God created the earth it was a scene of picturesque beauty, unbroken forests crowned the hills and valleys and Nature undisturbed for ages had wrought upon, and beneath the surface in preparation for the time when the hand of industry should cause the one to bloom as a garden and the other to give up its stores of untold wealth. He looked upon it as a fit habitation for the abode of mankind; but mankind saw that it was not necessary for him to cultivate the soil as there was an abundance of animals and fruits for his sustenance; hence, we have very little account of any of the cereals being raised until the time of the famine in Egypt. The tillage of the soil and raising of grain was only a side issue. But as time rolled on and conditions changed man saw that there was money as well as pleasure in the cultivation of grain—so that in all lands agriculture has been and will be a profitable employment. But no country has succeeded so well in agriculture as the United States, but we accomplished it at great hardship and expense.

Sturdy men with strong arms and stout hearts felled the forests. Brave women endured the loneliness of the wilderness, met the many perils and dangers of every day life with a heroism deserving of immortal remembrance. And in place of the forests, broad green fields enriched with labor and enriching the husbandman are in the place. Active, bustling villages and cities have effaced all signs of early hardship and suffering, and the old scenes about which we have lingered are no more. So pass our dreams. The infancy of Nature has reached its age; old-fashioned modes of life with their simplicity of manners have passed away with our forests; farm machinery which answered the purpose of its day has been supplanted by that which is more modern and serviceable.

But the question may be asked, How do we account for this advancement in agriculture? and the answer is simply by education. There was a time in the history of agriculture when our forefathers cleared our forests that all they had to do was to "tickle the soil" with a hoe, plant the seed and they were sure of a bountiful harvest. But they had no knowledge of the soil. They seemed to think that they could practice this method of farming without any depletion of the

soil, and the result was that the soil was becoming poorer and poorer; and then they began to search for a remedy for its restoration. The remedy came in our Agricultural Colleges and Experiment Stations, followed up later by our Farmers' Institutes and Granges and other kindred organizations.

Farmers of to-day know that in order to make their land produce they must feed it. You can't be taking from all the time and giving nothing in return, for as sure as you do you will come to the end. But then there is a class of people who see no good in anything; always satisfied with the present; never rising above the brute creation. To such people exhortation or advice would be like casting pearls before swine.

It should be the aim of every individual to make this world better by living in it; to make two blades of grass grow where only one grew before; to excel his forefathers; in short, to be the peer of everybody else. Never be satisfied with fairly good, pretty good or good enough. Accept nothing short of your best; your reputation is at stake in everything you do, and your reputation is your capital.

But what about the future of agriculture? What will we have accomplished in the next decade? During the next twenty years we are going to see a great revolution in farming. Agriculture is to be more intelligent and more intense; new plants will be introduced; a better use is to be made of the land, and an acre will produce twice as much as it now produces.

Beneath our feet is the fertile and productive soil. We have beautiful homes with everything needful to make life comfortable and worth living—all within easy reach. The hills, rock-ribbed and ancient as the sun; the vales stretching in pensive quietness between, the venerable woods, rivers that move in majesty, and the complaining brooks that make the meadows green.

ADDRESS OF GOVERNOR STUART.

I will be very glad, Mr. Herr, to meet the members of the Board. These proceedings are very interesting and very instructive. That address of Dr. Hunt was a very practical thing, and I think with that advice a little knowledge of farming, that almost any person could go into the business and make it successful. I have always held that the same energy that the young man puts in business in the city, put on the farm in the country would give better results very often than in the city. Because in the city he meets every competition; there he meets disappointments and very often it is not all the men in business in large cities who become millionaires. It is not all the men who become successful or will have enough after many years in business to retire with a competency. We hear of the successful ones, but never hear of the ones who have struggled just as hard as the successful ones and never been able to acquire a competency. If we could only get and induce the young man to stay and work on the farm, work

hard. It is not an easy life; but no success is easy. There are very few men that go to sleep who have success. Success comes first of all by industry. Secondly, by integrity in having people believe in you. And you can do that better on the farm than any other place I know. If we can, we must impress on the young men of this State the benefits to be derived from making an intelligent study of and following the business of agriculture. That has made this State great. We have labors to perform and great services not only to the State but to all the people and it is just such papers as read by Dr. Hunt, who knows and tells us what to do, that will enable us to accomplish what we should. If a man goes to farming, he must understand his business. If he is extravagant and buys this crushed rock at \$4.00 per ton when he can buy it at \$1.15 he will break up inside of a week just as he will if he does that kind of business in the city.

I would like to stay here with you longer. I enjoyed and appreciate the thoughts expressed in the practical paper of Mr. Bartley. After all, success means work, industry, application to your work. While a man may be unfortunate or may have some unfortunate condition brought into his life, there is no such thing as luck. It all depends upon work and energy and the integrity of the man. If you have a product you sell for \$2.00 to \$3.00 per bushel and it is good, the people will buy. If you try to deceive the people you will never succeed.

I did not intend to say anything here but I got enthused.

REPORT OF POMOLOGIST.

By GABRIEL HIESTER, *Harrisburg, Pa.*

Pomology correctly defined is "The science of growing fruit." I therefore conclude that the report of the Pomologist should deal with the advance that has been made during the past year in the science of growing fruit, and I shall confine myself to that subject.

ORCHARD MANAGEMENT.

Our State Experiment Station has for two years been conducting a line of experiments in eleven different orchards in widely different parts of the State which have been loaned by their owners for the purpose, to ascertain what effect the different substances used as fertilizers, namely, nitrogen, phosphoric acid and potash, have, first, on

INSECTICIDES AND FUNGICIDES.

For some years Bordeaux mixture has been considered the only reliable fungicide, but lately our orchardists have suffered considerably from what is known as Bordeaux russetting of fruit and Bordeaux injury to foliage. Our experimenters have been looking for a substitute which should possess as great fungicidal properties and at the same time prove harmless to fruit and foliage.

During the past year Professor Stewart, of our State Experiment Station force, has been studying very carefully the preparation of a concentrated lime-sulphur solution, its properties and uses, with special reference to its use as a summer spray. He has succeeded in making a concentrated solution, that can be held a long time without crystallizing, and can be diluted to the proper degree and applied cold at any time, thus doing away with the disagreeable work of boiling at the time of application and applying hot. He has also by a number of tests made by applying different strengths to all kinds of tender foliage in all kinds of weather determined with considerable accuracy what degree of dilution is necessary for the different kinds of fruit trees. A bulletin has been issued (State College Bulletin No. 92) giving in detail the method of preparation, and the apparatus needed, which is so simple that any grower of ordinary intelligence can make it. The bulletin also gives methods of testing its strength and the proper degree of dilution at which to apply it. While the results obtained in one season are not sufficient to definitely determine the exact value of the solutions recommended, not only our own experiment station but those of other states believe it is very valuable, and during the coming summer these sprays will be thoroughly tested by the various experiment stations and by a large number of commercial fruit growers in orchards all over the United States.

Our Economic Zoologist, Professor Surface, has given them a very thorough test in his demonstration work during the past season and expresses himself as much pleased with the results, which he has published in his December Bulletin. Professor Waite, of the United States Department of Agriculture has been experimenting with combinations of iron and sulphur, and while he is not yet ready to report results, he thinks he has found a compound that is absolutely harmless to both fruit and foliage yet is sure death to the spores of fungi. When we take into account the careful work that has been done and the satisfactory results that have been obtained in these first trials, I think we may safely say we have made a decided advance along these lines.

EFFECT OF SOIL AND SUBSOIL UPON DIFFERENT VARIETIES.

The effect of subsoil on varieties of fruit and also the effect of the same subsoil at different altitudes has long been recognized by some pomologists and by many practical fruit growers, but up to this time we have never succeeded in interesting either the National or State Department of Agriculture sufficiently to have a soil survey of the State made, for the purpose of determining the best location for the different varieties now under cultivation. I am informed by Dr. Hunt, Director of our Experiment Station, that he has great hopes that such a survey will be started before the close of this year.

PROBLEMS IN POLLENATION.

We know that there are few cultivated varieties of fruit which are able to fertilize themselves perfectly and completely, some of our best varieties, among which may be named the Baldwin, are practically self-sterile. No complete list has ever been made showing which are able to fertilize themselves and which are not. Sometimes we find that a variety will not set fruit with its own pollen, yet that pollen can be used on some other variety and produce good fruit. There is room for a good deal of work along this line of determining just what varieties are self-fertile, and ascertaining what varieties in cross-pollination will form the best pollinators. At this time, with our present knowledge, we can only say it is good foresight for the Horticulturist in planting an orchard to provide for cross-pollination. In my own practice, in an apple orchard planted two years ago I planted four rows of one variety and two rows of another alternately, and would not consider it safe to plant more than six rows of one variety.

FRUIT DISPLAY AT STATE COLLEGE.

The greatest advance, however, has been made by the individual fruit growers themselves in both knowledge and methods, as was shown by the magnificent display of fruit at State College during Farmers' Week, and at the annual meeting of the State Horticultural Association in Tunkhannock January 11-13. Two years ago one table was sufficient to hold the entire fruit display at the College, and many specimens showed blemishes caused by insects and fungus. This year tables occupying a space more than 100 feet in length were filled with perfect specimens gathered from twenty-one counties and representing sixty-four different orchards.

On inquiry we find that more spray machinery was purchased than ever before. More spraying was done, not only for the control of the scale, but also for other insect pests and fungous disease. More fertilizers were bought, more intelligence was displayed in selection and application, more trees were thinned, more care was exercised in grading and packing, more new attractive packages were used, and better prices ruled as a consequence. The itinerant tree peddler has had his day in Pennsylvania, the men who plant orchards now consider carefully the question of varieties. As a rule they confine themselves to three or four leading sorts which they believe will do best in their neighborhood, and buy direct from the nurseries, with the positive stipulation—No substitutes allowed—and in other ways show that they are carefully studying their business.

HORTICULTURE AT STATE COLLEGE.

To sum up this whole subject, I would say the greatest need of the

Professor Watts, head of the Department of Horticulture, has a fine class of young men specializing under his direction; he has them thoroughly enthused with their work, they are earnestly striving to get all out of their college course that they possibly can. Professor Watts is doing his utmost to give them what they want, but is greatly hampered in his work by not having a proper building for their use. The trustees have twice asked the Legislature for an appropriation for a horticultural building, the item has twice been cut out of the bill. It is time that this industry should receive the recognition at State College which its importance deserves, and this State Board cannot do anything that will so greatly aid the fruit interests of the State and be of such lasting benefit to the farmers' boys than to secure for them this building in which they may be prepared for their life work.

ADDRESS OF PROF. JOHN HAMILTON.

I try to get to this annual meeting that I may have the pleasure of looking into the faces of the members of this State Board. I am glad to come back not only to renew old acquaintance, but also for a reason that a friend of mine gave for returning to his old home town. He said that he tried to get back once a year to avoid having the boys on the street inquire: "Who is that old fellow?"

While sitting here listening to your discussions, I have been looking over the list of members and have been rather startled to find that there are only two living who were present when this Board was organized in 1876,—Secretary Edge and myself. I have been greatly interested in the work of this Board from its organization, for it marked the beginning of what has developed into a great movement, the carrying of the discoveries of agricultural science out to the people on the farms.

This Board and others like it have I think been of as great if not greater service to agriculture than any other organization or set of organizations. It made known to the mass of people the fact that there was such a thing as agricultural science, that it was something that men could take and use, and they demonstrated that the truths of science could be made intelligible to men who had never had the advantage of scientific study. This Board through its farmers' institutes has educated the public to appreciation of agriculture as a profession to an extent that could not have been done by any other agency.

The Board has done another thing,—it has shown the agricultural colleges their duty, that they are not to be content to sit in their class rooms and teach 25, 50 or 100 or more young men, but that they are to go out to the great body of people who cannot go to college and teach the truths of agriculture to them as well. In recognition of this duty, the Association of American Agricultural Colleges and Experiment Stations last August at their meeting in Portland, Oregon, changed their constitution to provide for a section on extension work. Formerly there were but two sections in the Association, one on college work, that is interior instruction, and the other on experiment station

work. Every land grant college, therefore, is now virtually pledged to the establishing and equipment of a department of extension in agriculture, and they are going out to teach the people much in the same way that this board of agriculture has been doing, only in a more specific and systematic manner.

In order to provide for this new work, a bill, making appropriation for its support, has been introduced in Congress, and is now before the committees of agriculture of the House and Senate. The bill appropriates ten thousand dollars to each State and Territory for the aid of extension work by the Land Grant Colleges, and after two years a sum in addition equal to any appropriation that a State may make not to exceed one cent per capita of its population. In Pennsylvania, where we have about seven millions people, if our legislature would appropriate seventy thousand dollars for extension work we would get a like amount from the general Government in addition to the ten thousand dollars originally given.

What you have done to bring about this action by the association of colleges and stations is seen in the unanimity with which they agreed to the measure. On a yea and nay call only nine votes were cast against it, and to the surprise of its friends, the vote was permitted to be taken with comparatively little preparatory discussion. Many of those who voted had previously been engaged in institute teaching until it was no longer a question with them as to the value or practicability of the method. These points had been conclusively shown by the institute experiment which the boards of agriculture had conducted.

In the United States today twenty-five agricultural colleges have already organized extension departments. Minnesota has 15 men doing extension work and nothing else; other States have a less number, but all are in earnest and are ready to extend the work as rapidly as means for the purpose can be secured. I predict that the time will come when the larger part of the work of the land grant colleges will be extension and not interior. They will have the interior work of course, for a great body of teachers will have to be prepared for extension work, and for teaching in the normal, high, and common schools, and for research and investigation work in the experiment stations.

In each state there are three great institutions that are going to be held responsible for the uplift of agriculture,—the agricultural college will be responsible for the educational side of the work; the experiment station for securing new truths and better methods to be put into practice by the people; and the State departments of agriculture for the administration of law, for the enactment of new laws and methods for protecting the people against fraud and adulteration, and the protection of crops against depredation by insects and fungous foes, and animals against contagious and infectious diseases.

There will be minor organizations and institutions as poultry associations, horticultural societies, breeders' organizations and the like, but any of one of these may fail to do its work and no one will hold it responsible; but should either the college or station or the department of agriculture fail the public will hold its governing body responsible and should hold them to account because upon these bodies the salvation of agriculture lies. What is to be done outside will be in co-operation with and not independent of these institutions.

I feel therefore that the Board can congratulate itself that it has brought about this wonderful revolution in agricultural education and progress, and that it has done it in such a brief period; that a movement begun in weakness comparatively few years ago has grown until it has become national in its scope and hundreds of thousands of farming people are being benefitted by it. Last year about three millions of people were in the farmers' institutes in the United States. It is going to take a large amount of money to carry on this extension work by the agricultural college in Pennsylvania, and this Board can do no greater service than help to get it.

Some one asked "What shall the Board do next?" There are many things to do. The Board has prepared the way for what we have. It may now take up some new features in extension in agriculture and experiment with them and demonstrate the best methods for carrying them on. There are the boys' and girls' institute. The Board can show educators how to reach the young people on the farms with agricultural information so as to keep them on the land and away from the fevered and precarious life of cities. The Board is going to show school teachers how to teach agriculture in the public schools, and they are going to take up that hitherto neglected work, the women's institute, and develop it into an organization equal at least to the institutes now operated for men. What is possible in this direction may be seen in Canada. Ten years ago women's institutes were started in the Province of Ontario. Last year they had an attendance of 119,000 women, while the farmers' institutes organized 25 years ago had only 110,000 in attendance. The women meet once a month and are educating each other as no other agency yet devised has been able to do. I would like to see the State Board of Pennsylvania and the Department take the advance in this women's institute work. We have not done much in this direction as yet. We have been busy taking care of the men, and have to a great extent neglected the home life on the farm. There is great need for the improvement of country homes and it is work fitting for this Board and this department and worthy of the best efforts that they can exert.

I am thankful that I have been permitted to be identified with this Board both as a member, and later as its secretary, and my heart goes out to you because of the noble work that you have accomplished during the years of your association as representatives of the agricultural industry of the State.

ADDRESS OF GENERAL BEAVER.

Mr. Chairman, I feel very profoundly on this subject of the control of the women's organization along this line. The idea of George Hutchison standing up and telling a lot of women how to cook is simply nonsense. They could all take him in their kitchen and set him to work and have nothing to eat. That's a simple proposition. But if you want to educate women in this State along the lines of home economics or domestic science, you can call it what you will, you have got to get the women educated first of all to organize their own ses-

sions and to have them ministered to by the women. The idea of having your Farmers' Institute instructors and lecturers standing up and taking a woman's model and telling a woman how to cut a dress and fit that model. It is nonsense. Of what interest to them, from a practical standpoint, is the study of agronomy except as to the results of it. It brings them the material out of which they are to feed their families, but how they are to do it is both a science and an art that are separate entirely from what we call agronomy as it is taught in our agricultural schools.

Now, I am glad to state that at State College we got started on this question of domestic science, home economics, and we got some of the most splendid girls in Pennsylvania there. The beauty of it is that they are so thoroughly enthused with it that they want to prepare themselves as teachers, nearly all of them, for imparting instruction on these vital subjects that go to the foundation of home-making, and when you say home-making you mean happiness-making as well as home. Our women are to be taught how to furnish a home, beautify the home, make it attractive to the inmates of the home; how to feed the inmates of the home, how to do it in the way that will be wholesome and at the same time appetizing. We have just finished a little laboratory in our women's department as we call it, for the analysis of foods to teach the women who are there the chemistry of foods so that they may know just as well as the farmer has to know what he had better feed his steer, what chemical elements enter into the food that is best for the steer. Isn't it just as important then for our women to know the chemical elements that enter into the foods that are best for her husband, her boys and girls, as well as the farmer who goes out to his barn ought to know what enters into the chemistry of his feeds he gives his cattle? Of course you can use such and such proportions of protein, etc., and when the cattle have taken on the fat that brings the result. But you don't get the same kind of results from the man. But the woman who can increase the gray matter up here (indicating his head) and put that into the production of the things that go to the steer after all makes the man a greater element, and great agent for the productive results of the farm. It is the gray matter all the time, and the woman that knows what to give to the man to increase the gray matter instead of making him corpulent is the woman you want.

The difficulty, of course, that we experience at State College and the difficulty you experience in town is, that when the woman gets to be just exactly what you want her to be for the place which she fills, some fellow comes along and offers a bigger salary,—not dollars and cents, of course, but in the home application of the home economics, of what she is master. Yesterday, to my utter disgust and disappointment, I might say, Dr. Sparks said to me, we are going to lose our woman's instructor. I said, "How is that; some institution offer her a bigger salary?" He said, No, but some other fellow has. Whilst you meet with little disappointments of this sort, I believe most heartily in what Prof. Hamilton has advocated in the education of the women along the lines of what a woman ought to know in order to make her home the best place on God's earth and to make it the happiest place for her boys so that they stay by her as long as they live, at least as long as they can. Maybe in the next generation they may get a woman who may make a better home than our mother has;

and though I have just as good a home as there is in the world, there are some things my mother did, some things your mother did, that come home to you that another woman cannot do just as mother did them.

REPORT OF THE COMMITTEE ON FRUIT AND FRUIT CULTURE.

By D. A. KNUPPENBURG, Chairman.

As Chairman of your Committee on Fruit and Fruit Culture, I beg leave to report as follows:

Yield in apples, not a full crop. In some places very good; others poor. Upon the whole a very good crop considering the unusually dry season. Prices range from 25 cents to \$2.00 per bushel. Peaches were a good crop and brought from 75 cents to \$2.00 per basket. Pears, plums and cherries gave very satisfactory returns.

New insects and diseases appear. A punky brown spot shown in depressions in the skin, chiefly in the York Imperial and Baldwin, damaging fruit many thousands of dollars in Pennsylvania and no remedy yet known.

A new pest called the Apple-seed Chalcis, has appeared. The apple ceases to grow at about one-third or one-half natural size and remains on the tree with a peculiar pinched appearance until fall, when its beauty and usefulness is nearly gone. In the seeds of this dwarfed apple we find a white maggot filling the seed cavity. A remedy for it is wanted. Plant lice, Codling moth, San Jose scale, and other insect pests have been unusually active, owing to the warm dry weather so favorable to their development. The Frog Eye or round leaf spot has continued to spread over the State. When sprayed with dilute lime and sulphur wash or Bordeaux mixture the disease was checked.

The various kinds of blights were not as destructive as usual owing, perhaps chiefly to the dry weather and consequent slow growth. This condition also probably accounts for the general absence of other plant diseases, such as brown rot or ripe rot, melon blight, potato blight, etc. A new fungicide that proved satisfactory where used, not strong enough to injure the leaves, was found in the lime-sulphur solution, both the self-boiled and the dilute commercial.

Still another pest, which is neither disease nor an insect, is the Leaf Blister Mite. This is more like a very minute spider, which lives in the tissues of the apple and pear leaves, making them look rough with blisters, which causes the leaves to fall prematurely, giving the tree a decidedly unhealthy appearance. It is prevented by spraying the trees thoroughly with the lime-sulphur wash just before the buds open.

Apples grown are Yellow Transparent, Summer Rambo, Red Astrachan. Among the old varieties the Jonathan brings the highest price, \$6.00 per barrel. The Smokehouse, Baldwin, Northern Spy, Rhode Island Greening, York Imperial and Ben Davis, with increas-

ing demand for Twenty Ounce and Fallawater. In the northern half of Pennsylvania the King and Gravenstein have been profitable. While Grime's Golden is rapidly coming into prominence, its running mate, Staman's Winesap is doubtless the best all around apple now being placed on the market. Among the new varieties, the Stark is worthy of mention and trial. Two high grade apples that ought to come into prominence are the Bonum and Mother apples; large, red, subacid, rich, delicious, and good keepers. However, we think it best to plant fewer varieties and those best adapted to your soil and climate.

ORCHARD MANAGEMENT.

We know of no commercial orchards that have been handled by the clean culture methods, although most of the successful peach orchards have been handled by clean culture. The method most common is the plain sod, but this means starvation to the trees unless fertilizers or manures be used. A good system is the sod mulch; by covering the sod with mulch as far as the branches extend. Mr. Earl Peters of York county has a fine four-year old apple orchard which he mulches with small brush with the leaves on, which seems to answer the purpose as well as straw. The branches hold the leaves from blowing away. Leaves hold moisture and furnish fertility as on the virgin soil. This orchard made twenty-three inches growth last season. For hillsides or rocky fields that cannot be cultivated, and where straw or manure cannot be had for mulch, this system, supplanted by the addition of some commercial fertilizer, should prove valuable. The best method for any young orchard that can be cultivated, is clean culture from early spring until midsummer, then sow clover or other legume for cover crop to plow down the following spring.

Through the influence of the great work that is now being carried on by the State Department of Agriculture, through the Division of Zoology and Farmers' Institutes, assisted by our State College, the farmers are taking courage, as they learn proper orchard management, the care of fruit and how to market it. It is estimated by good authority that Pennsylvania has now growing within its borders 33 per cent. more fruit than she had twelve months ago. The State demonstration orchards are proving that San Jose scale *can* be controlled. Codling moth suppressed, and clean well colored *excellent flavored* fruit *can* be grown in Pennsylvania, second to none in the United States. We have proof that fruit trees can be grown in our State of Pennsylvania as fast as in California, Oregon or Washington. In view of these facts and our nearness to the best markets in the world, Pennsylvania should move right up to the front and take her place where she rightfully belongs.

The meeting of the State Horticultural Society at Tunkhannock, Wyoming county, on January 11, 12 and 13, 1910, was well attended, and the good work done there by those in charge merits words of commendation. Such meetings held in the different fruit-growing sections of the State does a work that is highly appreciated by the people and will bring forth fruit a hundred fold in due time.

REPORT OF THE COMMITTEE ON ROADS AND ROAD LAWS.

By JOHN C. WELLER, *Chairman.*

The very dry summer and fall were favorable to road making and the continuous sunshine caused the dirt roads to remain in good condition until winter began, the frozen condition of the ground and the snow in many localities have made excellent roads during the winter months up to the present time.

In reply to a request for the latest annual report of the Highway Department, I very kindly received a communication culled from the report for the year 1908, now in the hands of the printer, outlining the work done by the Department during the year, which, I trust, will be of interest to the members of the State Board of Agriculture, and which I now offer as part of my remarks.

"The reconstruction work of the State Highway Department was successfully carried on in sixty counties, the counties in which no work was done being Juniata—because of no application being filed asking for State aid; Fulton and Susquehanna counties—because of the failure on the part of the County Commissioners to agree to proceed with the work; Pike and Wyoming counties, because the agreements to proceed with the work were signed too late to allow the work being commenced; and Lawrence county, because of the lack of sufficient funds to proceed with work for which bids had been received. 241 miles of township roads were reconstructed. 359 miles are under contract, of which 181 miles have been completed but not accepted from the contractors.

"Bids have been received on 11 miles additional to the mileage under contract. 566.2 miles have been fully completed and accepted from the contractors since the work of reconstruction began in 1904. The average cost of all work completed, based on a stone or brick road 16 feet wide, including bridges, culverts and drain pipes, is \$2.26 per lineal foot, or \$11,922.80 per mile. The cost of all additional work is 9.1 per cent. of the total cost of the roads. The cost of engineering on all roads so far completed averages 1.9 per cent. of the total cost of the work. The cost of inspection on all roads completed is 2.6 per cent. of the total cost.

"The building of bridges has been part of the work of the Department in connection with the reconstruction of township roads, and these have cost to date \$584,222.14. Had these bridges been in proper and substantial condition, as they should have been, the average cost of reconstructing the roads would have been about \$700.00 per mile less.

"During the year the Department has laid 232,108 square yards of brick pavement in reconstructing township roads, which yardage, figured on the basis of 16 feet in width, gives 24.73 miles. This work has been at a cost of \$481,566.72 complete, or an average of \$19,472.93 per mile. The average cost of all roads is \$2.26 per lineal foot, or \$11,922.80 per mile; deducting the cost of the brick roads the average for

telford-macadam roads is \$10,577.98. Bids recently received show that the average cost of reconstructing roads with bricks will be materially less than the present average of \$19,472.93. While the average cost of a road resurfaced with bricks is about 90 per cent. over that of a telford-macadam road, yet the average annual cost of repairs for fifteen or twenty or even twenty-five years in many cases should be practically nothing if those having in charge the maintenance of the roads will see that the ditches are kept open and all drain pipes and culverts kept clear of obstructions. In Greene county about four miles of brick road will be laid the coming season at a less cost per mile than a telford-macadam road. 2,139 applications on file call for the reconstruction of 4,190.7 miles of road. The detailed cost of each road built the past year is shown in the attached schedules.

"The Department has also during the past year reconstructed several sections of road with concrete, at a cost slightly in excess of the telford-macadam road, for the purpose of preventing destruction by high water, and, in the case of Mauch Chunk borough, to overcome the destructive force of automobile traffic. This section of road has a grade of 10 per cent. and had been badly ravelled from the traffic and was reconstructed as follows:

"All the macadam was picked up and screened twice, first through a one-inch mesh, which removed all stones under one inch size; and second, the residue was then thrown on a one-half inch mesh, thereby removing the dust. The larger stones, $1\frac{1}{2}$ inch to 1 inch, were used as the aggregate of the concrete and mixed in the proportions of 1-3-6 with bank sand and Portland cement. The mixture was deposited on the exposed telford, which had previously been swept clean and well sprinkled with water, and was tamped until about one inch of mortar showed on the top. The three-fourth inch stones were then sprinkled on top of this mortar and tamped until they were embedded about three-fourths their size. The dust obtained in the process of screening was then thrown on top of the work and the whole allowed to set one week before the travel was turned on it. This form of construction makes a good road, somewhat rigid for horse traffic, but one that will fairly well withstand the automobile traffic, and it is the intention to have more of it laid in the future.

"Several sections of bituminous-macadam road have been put down which at the present time are in good shape and look all right, but before this method of reconstruction can be adopted additional information as to the best methods to be pursued and the best material to

"The question of new methods of construction and of maintenance received considerable attention and were pretty thoroughly discussed at the First National Road Congress held in October last, in Paris. The representatives from the United States who attended the congress seem to be unanimous that the methods of construction in this country are equal to if not better than those in use abroad, but that the system of maintenance in this country is far behind that in use in England, France, and the other countries having good roads. Much bituminous material is used in the maintenance of stone roads abroad.

"One hundred and thirty-six plans for road work were received by the draughting department, of which number one hundred and thirty were completed and approved and which covered two hundred and thirty miles of road. For these plans there were designed one hundred and ninety-eight bridges and culverts. The bridges if connected would make a continuous span of 2,791 lineal feet. Standard plans have been completed for culverts and bridges of all spans from four feet to eighteen feet inclusive, and also standard sheets for all detail work. Work on county road map surveys and plans has been pushed as rapidly as possible and another year will see the same work in several of the counties completed and the maps platted. In addition to the regular plans for bridges to be used in reconstruction work, several plans for bridges have been furnished to county commissioners at their request and plans for small bridges and culverts have been furnished to borough and township authorities. Profiles and grades have also been furnished several boards of township supervisors at their request, with a view of changing the grades of township roads. The effort being made by many boards of township supervisors to better the condition of the public roads, by putting in permanent bridges in place of the old wooden ones, cast iron, concrete or corrugated pipe for drainage and the getting rid of the 'thank-you-ma'ams' is to be commended. The Department is always ready and willing to aid and assist any township in making such improvement if requested to do so by the township board of supervisors.

"Meetings of county organizations of supervisors were held in several counties with good results, the supervisors taking an active part in discussing various topics brought before the meetings. There should be a county organization of supervisors in each county, and eventually a State organization of supervisors. These organizations will be of mutual advantage and assistance to the Highway Department, being educational, and enabling the Department to keep in better touch with the supervisors and to obtain a better knowledge of the work being done by the several boards of township supervisors.

"The National or Cumberland Road which crosses the State through the counties of Somerset, Fayette and Washington, six and one-half miles in Somerset, thirty-five miles in Fayette and forty and one-half miles in Washington, a total distance of 82 miles, has been placed in as good a condition as possible with the funds at the disposal of the Department. The road was in a very bad condition when placed under the care of the Department in 1905; all of the bridges were in a very dilapidated condition, several having fallen down. The first care of the Department was to put the twenty-four bridges on the line of the road in repair and rebuild those that had fallen down, all of

which except four have been either rebuilt or repaired, at a cost of \$58,519.35. Seven and six-tenths miles of the road have been reconstructed and put in first class condition at a cost of \$99,725.34. \$7,961.12 were expended for labor and material for ordinary repairs. About five and one-half miles of the road is in the boroughs of Uniontown, Brownsville, Washington and West Washington and is being maintained by the respective boroughs through which the road passes. On many sections of the road traveling is dangerous because of wash-outs, and all of the road is very rough except the sections recently reconstructed. An appropriation, say of \$350,000.00 should be made which would enable the Department to put the whole road in first class condition within the next two years. The sooner the road is put in first class condition the better, and the biennial appropriation need not thereafter exceed the sum of \$25,000. It would also be on the line of economy for the State to own a suitable stone quarry, a portable stone crushing plant and a steam roller. The Old Pike or Cumberland Road is the property of the State and must be maintained by the State and should be so maintained as to be a fitting object lesson to that section of the Commonwealth.

AUTOMOBILE DIVISION.

"The number of motor-vehicle licenses issued for the year 1908 was 25,179, being an increase of 4,399 over 1907. About one-fourth of the total number of licenses issued were to non-residents. The gross receipts for the year were \$75,723.69, which amount was paid over to the State Treasurer. The expense of operating the Division for the year was \$22,866.67, leaving a balance of \$52,857.02 for the use of the State Highway Department, of which sum \$20,000.00 was appropriated by the Legislature for experiments and tests, leaving an unappropriated balance of \$32,857.02. A portion of the amount appropriated was used in the testing of rocks and other materials to determine their value for road construction purposes. Another portion of the fund was used in laying experimental sections of road with bituminous material and also with concrete. Additional experimental work along these lines will be done in 1909."

Since the organization of the Highway Department in 1904, I can safely say that not more than one thousand miles of road has been reconstructed in the entire State, and as it is estimated that there is more than ninety thousand miles of road in the State, we cannot

Pennsylvania upon which it could be used to good advantage. The road scraper or grader has done much in shaping the dirt roads of the State at much less expense than with plow and shovel.

It is during the rainy season that the dirt road is at its worst condition; then it seems to be bottomless. Could there not be a dirt road constructed with a telford foundation? In many localities where stones are plentiful I believe it would pay to plow the dirt road bed and remove to the side of the road, then use large stones for the foundation, then macadamize the top and use a light covering of dirt. In summer it would be a perfect road and during the rainy season the mud would not be deep.

The last Legislature amended the Road Law of 1905 by making the road tax payable in cash, and any district wishing to return to a work-tax can do so by a majority vote of the citizens of the district. Any township which shall have collected its road tax in cash shall annually receive from the State fifty per centum of the amount of road taxes collected in said township, as shown by a sworn statement of the board of supervisors. This act carries with it an appropriation of \$500,000.

It has been argued that much better labor could be secured on the roads by paying cash than by giving credit on labor tax. In some districts that have adopted the cash system the supervisors are not very loud in their praise of the change, saying they have difficulty in getting good workmen. How to secure better roads is surely a difficult problem to solve.

REPORT OF THE ENTOMOLOGIST.

By PROF. FRANKLIN MENGES, York, Pa.

SPRAYING.

Many farmers and also fruit growers have been disappointed with results of spraying and have become somewhat doubtful, not about spraying, but about spraying mixtures. The causes for these failures are usually too intricate and varied for the average farmer and fruit grower to fully or even partially understand. The failures may be traceable to not applying the spray at the right time when the insect is in the right stage of development for the spray solution to be effective, or the wrong solution may be applied, or the solution used be such that it effects the vitality of the trees and the fruit buds so that inferior fruit or no fruit at all will be produced.

SOME EFFECTS OF SPRAYING.

In the springs of 1907 and 1908 I sprayed my peach trees with an oil mixture at the special request of an agent of the oil sprays. Previous to this I had sprayed with the lime and sulphur mixture and had large crops of fruit every year and the trees were free from scale. During the summer of 1907 the trees yielded not over a fourth of a

crop of peaches and they became so badly infested with San Jose scale that I was obliged to spray in the fall which should not have been necessary if the representations of the oil sprays agent had been correct. But my confidence in the oil sprays, or rather in the representations of the oil spray agent, had been established and I attributed the scale infection to the English sparrows having carried these from neighboring trees, none of which had been sprayed and were full of scale. Not only were the trees infected with the scale, but they had lost their former vigor and during the summer of 1907 very small peaches appeared here and there on a Schmauk tree. I had heard of what is called "little peach" but thought likely there was no such thing on my trees. In the spring of 1908 one of the most vigorous of my experimental trees was dead. This spring I again sprayed with the oil mixture. This year the crop of good fruit was very small but the crop of "little peach" was all one would hope for had they been large. In conversing with peach growers I told of my experience and by them was told that I had "little peach" and that the only thing to do was to cut down the trees and to burn them. I did not cut them down and burn them; neither did I spray in the fall of 1908. In the spring of 1909 the trees were not in appearance or vitality what they had been before I sprayed them with the oil mixture and therefore concluded that they had about enough of that kind of treatment and I then sprayed them with the lime and sulphur mixture. The spring weather was rather unfavorable, especially during the blossoming season when we had days of rainy weather and hard rains which lasted for hours and which did much damage to the blossoms on the side of the trees upon which the strong wind blew the rain. I saw apple trees in some of the Adams county orchards which were exposed to this storm that had very few apples on the side of the trees exposed to the direction of the wind and rain, so that if the failure of the previous years could have been attributed to climatic conditions, or the "little peach" to injuries to the buds there was sufficient reason for not having fruit and for "little peach" this year. During the summer of 1909 I had a splendid crop of peaches and not a single "little peach" of which I had so large a crop, especially on a Schmauk tree, the year before. I am not going to draw any conclusions, but one thing I am not going to do again,—spray peach trees with oil mixtures. I said I would not draw any conclusions but is it not evident from what I have said, and from what others have observed and experienced, that before a spray mixture is put upon the market and before it receives the endorsement of any one upon whose opinion the public has a right to rely, that it should be thoroughly

or arsenate of lead and sometimes Paris green produce rusted fruit and prevents apples from coloring up right. We know that Paris green burns the leaf of potatoes and the apple and other fruit trees, and that the causticity of our most prophylactic of all sprays, the lime and sulphur, weakens the delicate fruit buds of the apricot as well as others. When we know more we will have a spraying substance that will be beneficial to tree and bud while destroying insects and fungi.

CONDITION OF THE APPLE CROP.

This brings us to the peculiar condition of the apple crop over a wide expanse of country reported to us by Mr. D. H. Watts, of Kerrmoor, Clearfield county, Pa. Mr. Watts says the short apple crop in his section was not due to insufficient blooming but rather, as he thinks, to a generally unfavorable climatic condition that prevailed during the early stages of the growth of the fruit for a shorter or longer time. Other growers in Clearfield and other counties in which the little, knotty, deformed and highly colored apples hung in numerous clusters of handfuls on the limbs of trees think that it was the result if insect infection. But these parties have so far utterly failed to name or identify the insect pest that has committed these depredations, nor have they specified the time when it was done. Sprayed and unsprayed orchards were equally affected. Mr. Watts reports one peculiar condition that came to his notice, and likely there were others, of a small family orchard, of old standard varieties of apples, located in a damp clay soil in the valley of a small stream in which almost all the apples were perfect while in all the surrounding orchards the little apples, as already described, were plentiful.

Mr. A. J. Kahler, of Hughesville, Lycoming county, Pa., reports the appearance of what he terms the "field wheat weevil." Mr. Kahler says: "We had quite a scourge of this pest for three years commencing, as nearly as I can remember, with the harvest of 1854 and continuing during 1855 and 1856. We noticed in our wheat in 1854 that a great many grains in the heads were missing and where there should have been a grain we found a little white worm which, when full grown, was about the size of a grain of wheat. The following harvest, that is, 1855, it destroyed nearly the entire crop of wheat in our community. Field after field was eaten up and not worth harvesting. Many farmers plowed it down and others cut it for the straw. We had several fields of as fine a straw as we ever had, the grain of which was entirely eaten up.

"I will now give you a description of the insect and what it is like. They were small black flies, about one-half inch in length, and appeared in clouds on the wheat especially in the morning and evening towards sunset. They stung and deposited an egg in the hull that incases the grain. Well nigh every pod in every head was stung. We noticed that when these eggs were deposited in hulls in which the grains had about fully developed, that the little worm could do little or no damage. The only thing we could do, noticing this fact, was to try to get the wheat to develop early and we found that wherever we could get it ahead to develop the grain the first few weeks in June, the little worm could do little or no damage. In this way, in a great measure, we became master of the situation. By sowing early, by the middle of August we got our wheat out of the breeding time of the

fly and it disappeared. This we continued doing until we had to sow later on account of the Hessian fly. Last summer this same field weevil made its appearance again, especially on the farm of Mr. John King who had a very elegant field of late wheat which looked fine but when they came to thresh the wheat they found many of the grains partially eaten and large numbers of the little white worms in the screenings. When we threshed our own wheat we found quite a number of these worms and many shrunken grains, showing that they were infested."

The potato bug was again in evidence in the early part of the summer but later, evidently in the stage of pupation, either because of the dryness of the weather or because of some fungicidal or insect enemy few passed through this stage of transformation.

The greatest damage to the vegetable crops, and in many instances to fruit, was done by the aphids. The cabbage aphid was so plentiful in sections of York county that it well nigh ruined acres upon acres of cabbage and, according to a report I received from my friend, Mr. W. H. Stout, of Pinegrove, Schuylkill county, Pa., this was true of that county.

The Department of Agriculture has kept up the warfare with the insects of the State, not only by telling how to destroy them, but also by having the insecticides analyzed, especially Paris green and has thus complied with the law requiring this insecticide to be kept up to a standard of purity that when applied in quantities ranging from six to eight ounces in fifty gallons of water it will be effective in destroying chewing insects.

THE AMERICAN FARMER: HIS PAST, PRESENT AND FUTURE.

By E. B. DORSETT, Mansfield, Pa.

THE FARMER OF THE PAST.

Many years have elapsed since the American farmer began his work of building this nation; and though he later demonstrated his great power in saving it from being rent in twain, and is now recognized as the backbone of the nation, its brain and brawn, yet there are some who are still unkind or unthoughtful enough to call him "Clodhopper," "Buckwheater," or "Rube, the Hayseed." Notwithstanding this condition, we are still living in the best country and under the best government that the sun ever shone upon; and I assume that every person within the sound of my voice will subscribe to this sentiment. In spite of the many evils which exist and the many changes that might be made for the better, and notwithstanding the uneven distribution of the nation's wealth and the arrogant manner in which capital rules, it is still the best and the greatest country on the face of the globe and I desire to emphasize the fact that "Rube, the Hayseed," has been the greatest factor in its upbuilding.

Let us follow him from the time that he landed on the shore at Plymouth Rock and took possession of everything in sight. From that very moment he has ever been the aggressor. The moral phase of his position we will not here discuss; but simply say that he was proud of his possession and gloried in his strength. He was living in the days of aggression, at a time when might made right, when men were ruled by the sword, and when the Lord seemed to be on the side of the heaviest artillery.

His first great work was to clear his farm on the rough New England hillside, and with the rocks which he dug from the soil he made a schoolhouse, in which he laid the foundation for his empire. How well he built he never fully knew; but the fact remains that the little red schoolhouse was the keynote to his success during all the ages that have passed and gone. Out of those buildings have gone not only his children, but his children's children trained and equipped for the battles of life. His early trials and struggles are a matter of history and need not be repeated here. We see him bending under the yoke of bondage placed on him by the Mother country. We see him struggling manfully to adjust the burdens of local government, until finally the yoke of oppression becomes so burdensome that he is forced to throw it off. The Articles of Confederation are superseded by the Constitution of the United States of America, and the Stars and Stripes float over the new born nation. In the selection of a President for this new nation, his mind instinctively turns towards one of his own class; and George Washington, the farmer, soldier, patriot, general and statesman, was chosen for this important position. Thus, we see in the very beginning of the history of this nation, the American farmer was signally honored and justly so.

Having built well the foundation for his new empire, he now gives his time and attention to its extension and upbuilding. With his back towards the rising sun, his axe on one shoulder and his musket on the other, he turns his face towards the west and marks the course of his empire. In the Mohawk Valley he pauses and builds a schoolhouse out of the rough and unhewn logs cut from the forest. The Middle West surrendered 1,000,000 fertile acres to his plow, and here he builds his schoolhouse out of sawed boards and bricks, roofing it with shingles. Still onward, untiring and aggressive, he continues to plow the straight furrow westward and to dot the landscape with schoolhouses—forest or prairie, mountain or valley, always a schoolhouse.

He now turns and looks backward over his pathway. He sees the little old stone schoolhouse built on the New England hillside grown into a stately college, and the little clearings which he had made in the forests grown into towns and cities. On some of his roads were iron rails, over which steam cars were running, and the waterways were being plied with ships of commerce.

Encouraged by his successes and achievements, he again faces westward, though he pauses during the space of four years to settle a difference of opinion between him and his brother Jonathan in the South, as to the preservation and perpetuation of the Union, something that had become near and dear to his heart, an institution that was part of his very life and religion, one which was the outgrowth of justice and equity and the result of early teachings in the little log schoolhouse.

Firm in the belief that he was right, his Southern brother threatened to overthrow the entire fabric, and cause the dissolution and disintegration of the Federation of States. "Rube" saw the work of four generations in peril. "Dissolve this mighty Union!" He cried, "Never!" He stopped, he considered and the more he considered the more incensed he became, until finally he unyoked his oxen from the plow, brought forth his grandfather's old musket, and in the twinkling of an eye he became a warrior. The quiet, peace-loving, home-loving, hard-working, hard-fighting, and all-around-hard-to-beat tiller of the soil, takes up the trade of war, and for four long years his trade was war, cruel, remorseless war; and when it was over, when victory was won, did he boast over it, or follow up his advantages for revenge or conquest? No! He extended the hand of fellowship to his Southern brother and said: "Go back home to your cotton fields and I will go back to my corn. I have helped to save you from yourself and henceforth we will work together. In the future we will work for the glory and honor of our common country. Shoulder to shoulder we will build such an empire as the world has never seen."

In six months the farm, the shop, the mines and the professions had absorbed that mighty army whose trade had been war. There was no tremendous upheaval in the order of things, no riots and no bloodshed. Quietly and peacefully the sword was converted into a corn knife, the cannon into plow shares, and the fields which ran wet with blood in the spring were golden with the harvest in the autumn.

Match it in history if you can. Peace and harmony having been restored, "Rube" again takes up the furrow where he had left it, and with his face still towards the West he enters the great American Desert. On the alkali plains he digs an irrigation ditch, and sows its banks with alfalfa. Here his schoolhouse is a dug-out abode. In the valley of the Sierra Nevada he plants vineyards, and beyond the great range an orange grove, and geographically, the scope of his empire is complete.

THE FARMER OF THE PRESENT.

Such in brief is a history of the American farmer of the past. We find the farmer of the present still trying to solve some of the same questions, though perhaps differently stated, as perplexed his forefathers in the days of the Revolution. If taxation without representation was tyranny then it is doubly so now, yet we find that the farmer of to-day pays an average rate of sixteen mills taxation on the dollar, while corporate interests pay but four; and at the same time his voice is seldom heard in our halls of legislation.

From out of the ashes of the great Civil War, ashes sprinkled with tears of our glorious American women, and wet with the blood of her bravest and best manhood, there has developed a new menace, which is destined to make more trouble for our American farmers of to-day than did the War itself.

The power of unearned and concentrated capital is only just beginning to be felt; but the necessities of that War opened up a new and hitherto unknown and untrodden field of financial exploitation; new and untried fields for the accumulation of vast wealth. Capital ever greedy, ever ready to take advantage of every necessity, begins to make its power known. Its advance is slow, creeping, cringing and

insidious. It always wears a smile, smirks and bows, and rubs its hands with glee as it creeps onward. Thus far "Rube" has taken little or no notice of this. He exchanges smile for smile, and likes to be flattered, it tickles his vanity. He is proud of his country's progress proud of her great cities and proud of her railroads, he is even proud of her captains of industry, feeling that he had a part in their creation, little realizing how great a part.

Instead of taking an active interest in governmental affairs, and in securing legislation protecting his interest, as did his forefathers, he is often careless and indifferent as to the character of the men whom he elects to enact laws, and, at times, criminally negligent in his choice of men to administer them.

How absurd then, for the farmer to growl about not getting a square deal, or to even think of getting justice and equity, either in the enactment or the enforcement of any law that is made, interpreted and administered by men whose business interests are not in sympathy with and often antagonistic to that of agriculture.

This State Board, with its splendid system of Institutes and Movable Schools, is doing much for the farmer of the present; and yet its work has only just begun. It is highly important that he should be taught some of the fundamental principles of scientific agriculture, how to secure and maintain soil fertility, how to plant and care for the orchard, how to feed and care for the stock on the farm, how to increase plant growth; and in short, how to reduce the cost and increase the production. Then, having learned all this, and having made two blades of grass grow where but one grew before, what will it profit him, if by a system of unjust taxation or class legislation, some other fellow gets the extra blade?

This is a condition that confronts the farmer of the present and must be remedied by the farmer of the future if he would hope to win success. It has taken the farmer a long time to realize all this, it was hard for him to understand and still harder for him to believe. His rugged honesty revolts at the thought. The log schoolhouse did not teach him the art of graft, political science, nor frenzied finance, as applied to-day; but it did give him greed for knowledge, and as suddenly as before, when he became a warrior, he now becomes a reader and a thinker.

THE FARMER OF THE FUTURE.

Let us lift the veil, and as we look down through the vista of the coming years, we catch a glimpse of the American farmer of the future. We see him come forth a full-fledged, well-rounded, broad-minded practical farmer. The scales will have fallen from his eyes and all prejudice to "Book Farming" will have vanished from his mind.

Our own splendid State College will have taught him how to apply science to the art of agriculture, and having drank at its fountain, he will accept agricultural education as a necessity not only for himself but for his children. He will understand soil types, and be able to classify them with reference to crop adaptation, thus eliminating waste through lack of knowledge. The principles underlying soil fertility will have been so well-grounded into his early training that he will not only understand how to secure it, but will fully understand how to maintain it when once it is secured. Feeding the plants will

be quite as profitable and fully as important as feeding the animals. He will have learned that single-handed and alone he can accomplish but little; and this fact alone will have caused him to give up that independent life which isolated him from his fellow farmers and prevented him from making real progress.

The spirit of co-operation will be an important factor in his makeup and he will always be found ready and willing to lend his voice and vote to promote every public or private enterprise that is progressive and tends to better agricultural life. He will not balk at the occasional failure of a leader, but will pull steadily and faithfully on to the end of the furrow or until the span of life has been completed.

Again, as in days of yore, we see him turn instinctly towards his own, the Grange. There he learns that the true secret of his success lies in intelligent organization. He enters her portals and there is taught that if he would win success, he must present the same solid front to the enemy that he did in the days of the Rebellion. We see him go to the polls and vote, not as the party boss dictates, but as best protects the interests of his fellow farmers and the common good of humanity, placing principle above party affiliations. Quietly he gathers up the reins, which fell from his hands at the call of his country, and proceeds to drive.

He enters our State and National halls of legislation, and as a result of his efforts, we see the State and the Nation join hands with him in building and maintaining public roads. We see the Parcel Post established, and well-managed under the improved and extended Rural Delivery, a child of the Grange. We see the citizens go to the polls and vote direct for the President and United States Senators, thus preventing, in a measure, the illegal use of money in politics, and making the individual responsible for the character of the men whom he assists in placing in office.

Lastly, we see the little red schoolhouse with which "Rube" dotted the landscape from the Atlantic to the Pacific, supplanted by the Township High School, surrounded with a plot of tillable land and well equipped with barns, built according to modern architecture, a building for manual training and a kitchen where Domestic Science is taught.

Let us enter the class room and listen to the instruction imparted. The pupils are taught that he who brings nothing but a creed, should be relegated to the past; but he who brings Christ's doctrine, "Peace on earth and good will toward men," will always be welcomed. War is barbarous and unworthy our American civilization, and he who prevents war, is greater than he who wins on the field of battle. You have entered upon an era of universal peace, and you shall say to the capitalist: "Render unto Caesar the things that are Caesar's and unto God the things that are God's."

The people have come unto their own. Henceforth you will all be captains of industry. Remember that "Rube" with his log schoolhouse, built the foundation for his empire on firmer rock than ignorance and superstition, more stable and more lasting than the rule of the sword, and more just and equitable than the rule of capital, as it is founded upon the universal Brotherhood of man and the over-shadowing Fatherhood of God.

THE PURE BRED VS. THE SCRUB STEER.

By DR. H. P. ARMSBY, *State College, Pa.*

Mr. President and Gentlemen of the State Board of Agriculture: All of us who have read the newspapers of late, and what good American does not, have received a great deal of information about the increased cost of living. Indeed, I rather suspect that most of us do not need to go to the newspapers to get that intelligence but have had it brought home to us in a much more practical way. Now I do not propose, of course, to discuss this very important and very complicated question to-night, and yet the matters which I have to present have some pretty definite relation to some phases of this question. While the increased cost of living doubtless has many causes, there is certainly one fact affecting the price of food concerning which we can all agree, viz: that there are more and more of us to be fed, consequently, it takes more food to go around, and the natural tendency of that is to make the cost of food higher. Moreover, this is a question which will affect us still more in the future. A very eminent agriculturist of this country, the dean of one of our leading colleges of agriculture, predicted the other day that by the end of this century we might have a population of twelve hundred millions. Even if we cut that estimate in half and say six hundred millions, it takes no profound thinking to see that the problem of feeding five or six million people in this country will be a tremendous one. Not long ago we were warned by President Hill, of the Great Northern Railroad, of an impending shortage in our wheat crop. He ventured the prediction that within forty years we should have a shortage of four hundred million bushels a year; that we should be importing wheat into this country.

Now, whether this time is coming sooner or later, there can be no question that sometime the question of the food supply is going to be a very serious problem. The food which we eat supplies the energy which runs our bodily machinery, and this energy is derived, ultimately from the sun's rays. By means of the green leaves of growing plants the farmer catches some of this energy which comes to us from the sun and stores it in the crops which he produces, and this energy is again set free in our bodies when we consume the food products with which he supplies us. The number of people that can be supported by any country from its own resources depends upon how much of this sun energy the farmer can catch for us. But a great deal of the energy that the farmer stores up is contained in unavailable material. For instance, when he grows an acre of wheat he stores up a certain amount of sun-energy for our use, but about half of it is contained in the straw and we have not learned yet how to eat straw. Moreover, when we grind the grain, about one-fourth goes into the bran and middlings and about three-fourths, roughly, into the flour; so that out of the total energy of the wheat crop less than thirty per cent. is actually available as human food to run our body machinery while sixty per

cent. is unavailable. Substantially the same thing is true of other crops, such as corn, rye and oats, and still more true of hay and forage crops which we cannot consume at all ourselves. As population increases, then, we shall be forced to be more economical in our use of the food supply. When we have a population of twelve hundred or even six hundred millions we cannot afford to throw away sixty per cent. of the energy of the wheat crop if it is possible to save any of it. Such a saving we can effect through feeding these waste products to our domestic animals, which can consume hay, straw, bran, etc., and work them over, using them to support their own bodies and leaving a surplus for human food, so that we may thus save a part of the energy that would otherwise go to waste. Now the Institute of Animal Nutrition has been for several years engaged in investigations by which we hope to get at some of the fundamental principles involved in this transformation of unavailable into available food material and to determine how much is necessarily wasted in the process and how, in any way, that waste can be diminished;—how we can save more of this waste energy to feed the coming millions that are going to inhabit this country. It is to one particular phase of that problem that I ask your attention to-night.

We are working along three general lines. In the first place, it is important that the stock feeder of the future shall know how to use the new feeds that are coming in the market. When stock raising was simply a question of grazing the stock or of feeding the grain produced on the farm, it was a simple matter; but when we have to depend upon these strange materials, these by-products and wastes of all sorts of manufacturing operations and, moreover, must use them with the greatest economy, the problem is a much more complicated one. We need to know the fundamental principles involved better than we have ever known them in the past. We must know the relative values of these feeds; how much of the potential energy in them can be actually digested by our farm animals; how they compare with each other in this respect; how much of the stored up energy is waste and how much can be utilized and thus saved for man; how they may best be combined for this purpose. In the second place, we need to know something about the efficiency of the machines that are to convert unavailable into available matter; whether different species and types of animals differ, so that one can utilize more of this otherwise waste energy than can another. In the third place, we need to know under what conditions we should place these machines to have them work to their greatest capacity; that is, how the conditions under which animals are kept affect their efficiency in converting unavailable into available material.

What I have to say to you relates especially to the second phase, namely, the relative efficiency of different types of animals, specifically of beef animals, in converting these waste products into human food. We do not need the physiologist nor the respiration calorimeter to tell us that some beef cattle give better returns for their feed than others do. But it is not enough simply to know the fact; we want to know why. If a manufacturer of cotton cloth had machines in his mill, some of which produced 1,000 yards of cloth and others 1,200 and others 900 out of the same amount of cotton, he would not only want to know that fact, but also in just what respect some of the machines were better than others so that he could buy the better type

of machines. So in the matter of beef production, we know that this animal gives better returns for food than the other, but when we find that out it is too late to do anything about it. We have expended time and feed on the inferior animal and there is no possibility of going back and doing it over again. Nor does it help us in determining the particular kind of animal which will give us the best returns next time. We need to know in just what particular the good animal differs from the poorer one. Does he digest his food better? Some say this is the reason. If that is true it is important that the breeders of beef animals should know it and should breed so as to perpetuate that desirable feature and secure beef producing animals that will have this high digestive capacity. But, if on the other hand the difference does not lie in the digestive capacity, then we don't need to bother with that. Does the beef animal make a better use of the food he does digest; does he make more meat out of the same food than does the scrub steer? If such is the case, we want to know it and to breed from the animals that have this capacity in the highest degree, while if there is no such difference we can save ourselves that trouble and look further for the cause.

I am going to present to you to-night the results of some comparisons between the pure-bred beef steer and the scrub on some of these points, the actual results of experiments extending over about three years. We selected for this purpose two calves about ten months old. One was a pure bred Aberdeen-Angus and the other a scrub, more or less of the dairy type. We had these animals under observation for two and a half years and we tried to determine how much of their food went to waste and what percentage of it they were actually able to convert into meat for human consumption. Of course, the value of our results depends in the first place upon whether the animals selected were fairly representative of the two types. I shall let you judge of that by having projected upon the screen some of the photographs of them which were taken so that you can see for yourself what they looked like. (Photographs of the animals at three different ages were shown).

The first point that we wanted to determine was whether these animals had any difference in digestive power. For that purpose we made a series of digestive experiments. (Slides of the appliances used were shown.)

The following table shows the comparative digestibility of the hay and of the mixed grain consumed by the two animals in the third season's experiments:

PERCENTAGE OF DIGESTIBILITY OF FEED.

	Hay.		Grain.	
	Steer A.	Steer B.	Steer A.	Steer B.

I have selected these results because they are typical of all the others. In the earlier years there seemed to be a trifling advantage on the side of the scrub, while in the third year, as the foregoing figures show, there was, on the whole, a little advantage on the side of the pure-bred animal but so little as to be of no significance. In other words, so far as we can judge from these two animals, any superiority on the part of the pure-bred animal did not lie in his digestive power. Digestion is a chemical rather than a vital process, and the difference was usually very small.

In the second place, having tested this question of digestibility, we wished to find out whether one of these animals made any better use of the digested food than did the other. This is a far more difficult problem. We sought to solve it by studying the food as the source of energy to the body, determining how much of the energy contained in the digested matter the steer was able to store up in his body and how much went to waste in the form of heat or escaped unused in the excreta. For this purpose we used the respiration calorimeter which many of you have seen. (Slides illustrating the respiration calorimeter were shown.)

Without entering into the details of these elaborate experiments, it may suffice to say that the third year's experiments with the respiration calorimeter on the nearly mature animals showed that not only did the two steers digest their feed to the same extent, but that the percentage of the energy of the digested feed which was utilized in the body, either for purpose of maintenance or for the fattening, was substantially the same in the two animals. In other words, a pound of digestible food or a unit of energy supplied in excess of that required to maintain the animals was about equally well utilized by the two mature animals.

In the experiments of the first two years, on the other hand, made while the animals were still growing, there appeared to be a distinct advantage on the side of the pure-bred steer. After his maintenance requirement was satisfied, he seemed to be able to store up a somewhat larger proportion of the energy of his surplus food and this was true both of the hay and of the grain. The exact cause of this difference is not very apparent. It can hardly have been due to the difference in age alone for comparisons upon the same animal in the successive years showed a slightly better utilization of the energy of the feed by the older as compared with the younger animals.

Another, and a very important difference in favor of the pure-bred animal, was found in the maintenance requirement. Computed to the same live weight, the scrub steer required about 20 per cent. more feed for simple maintenance than did the pure-bred animal. In other words, while the scrub was able to convert his surplus feed into meat as economically as the pure-bred, he had a smaller surplus remaining out of a given amount of total feed because he used up more of it for the simple running of the bodily machinery. The difference in maintenance requirement appears to have been due to the more nervous temperament of the scrub and his greater restlessness as compared with the more phlegmatic temperament of the pure-bred animal.

A significant difference was also found in the feeding capacity. The pure-bred animal was able to consume and utilize heavier rations than the scrub. The heavier the ration of an animal, however, other

things being equal, the larger is the proportion of it which can be used for productive purposes, since the maintenance requirement remains the same. Accordingly, the pure-bred animal was able to make a more economical use of his total feed than did the scrub. This was especially marked in the third year's experiment when the animals were fattening rather than growing.

These statements are in apparent conflict with the fact that, as has been frequently observed in such experiments, the rate of growth of the scrub, as measured by the gain in live weight during the two and a half years, was fully as great as that of the pure-bred and required no greater weight of feed to produce it. The experiments seem to show quite clearly, however, that this discrepancy is due to the fact that a pound of gain in live weight contained considerably more actual food value in the case of the pure-bred animal than in that of the scrub, the difference being largely in the percentage of water. In other words, the scrub put more water into his gain than did the pure-bred animal and consequently was able to make relatively as large gains in live weight from the same food.

SULPHATE OF AMMONIA.

By C. G. ATWATER, New York.

When the subject of fertilizers is brought up before a meeting of agriculturists, in Pennsylvania, it seems to me that some reference to sulphate of ammonia is in order. Sulphate of ammonia is produced from bituminous coal, in making it into coke in the by-product coke oven, and the State of Pennsylvania leads all the other states of the Union both in resources of coking coal, in the production of bituminous coal and the making of coke.

Sulphate of ammonia is important in agriculture because of the nitrogen it contains. This amounts to 20.5 per cent. by weight. Before an audience of farmers there is no need of my dwelling on the value of the nitrogen. It is the scantiest in supply and the most expensive of the three principal plant foods. It is also the one most easily lost by exposure to the elements or exhausted by heavy cropping. A pound of nitrogen costs on the market three times as much as a pound of phosphoric acid or of potash. The agriculture of a country may fairly be said to depend on its resources of available nitrogen, because it is usually the first to fail, its lack being the usual reason for scanty crops. We have long ago exhausted the original fertility of our virgin soils, in this State at least, and the supply of nitrogen from the waste products of the stock yards and kindred sources is now exceeded by the demand, so that the price has risen steadily. Yet the demand goes on increasing.

There is, however, one source of combined nitrogen that we have hardly touched, namely, that in our bituminous coal. I will try to indicate to you how great this is. Pennsylvania mined in 1907 about

150,000,000 tons of bituminous and semi-bituminous coal. This coal could have been made to yield 3,000,000,000 pounds of sulphate of ammonia. Actually there was perhaps four times as much in the coal as this, but this is the amount that may be reckoned as readily recoverable from a practical manufacturing standpoint. Now, there are about 13,000,000 acres of improved farm land in the State, and if this coal had been treated for its by-products and the sulphate of ammonia distributed equally, each acre would have received 230 pounds. This is a heavier application than almost any one except the market gardeners think of making, and is the equivalent of 47 pounds of nitrogen, as much as would be obtained in one and a third tons of the ordinary 2-8-2 mixed fertilizer. What such an application would have done for the crops of the State you can imagine as well as myself, and this application would not be for one year, but for each and every year. We may state it in another way: A four-foot seam of coal is about as thin as our miners think it pays to work. An acre of this seam will yield about 4,800 tons of coal, from which the by-product coke oven or the coal gas retort will recover enough sulphate of ammonia to put 150 pounds on the acre of land every year for 644 years.

In the light of these figures, I think you will agree with me when I state, that the coal mines of the State of Pennsylvania represent one of her greatest potential sources of fertility, and that it is high time they were being called upon to put this fertility at the disposal of the farmer instead of wasting nearly all of it as is now done. The method by which this ammonia may be recovered consists in making the coal into coke, and this must be done in the coal gas retort or in the by-product coke oven instead of the wasteful bee-hive coke oven now generally employed. It would not be possible, of course, to make all the coal mined in Pennsylvania into coke as much of it is burned as fuel or shipped out of the State, although it is a fact that a smokeless coke is a better fuel for most purposes than a smoke-producing bituminous coal. But of the 150,000,000 tons of bituminous coal mined in 1907, 40,000,000, or over a quarter, were made into coke. The ammonia recoverable from this amount would still be important and could fairly be claimed by the agriculture of the State as its due. It would amount to 400,000 tons of sulphate of ammonia. In order to judge whether such a large amount may be considered as practically recoverable we have only to glance at Germany and England. Pennsylvania produced about 26,000,000 tons of coke last year. Germany produced 21,000,000 tons. Yet Germany recovered from her coke ovens the equivalent of 340,000 tons of sulphate of ammonia; whereas, the recovery from Pennsylvania's larger coke product was hardly a tenth as much. England with a larger coke production than

creasing. But the iron and steel manufacturers say, "Our business is to make coke and pig iron. We do not know anything about this chemical business. If we all build by-product coke ovens the market will be over-supplied with sulphate of ammonia and it will not be worth anything. The farmer does not want it anyway." And meanwhile the farmer says nothing. The matter has never been brought to his attention.

Therefore, I wish to say to you, examine the facts and figures as I have given them to you. Convince yourself that they are correct and then raise your voices in protest. Let it be known that the farmers can use sulphate of ammonia in their business and that they are willing to use it if it is supplied at a fair price, and there is little doubt that the supply will be forthcoming.

I shall be here after the session and shall be glad to answer any question you might like to ask. It is not proper for me to occupy any more time.

REPORT OF THE COMMITTEE ON LIVESTOCK.

By M. P. SHOEMAKER, Chairman.

The Livestock industry of Pennsylvania is not only of interest to the producer but to the consumer as well. The report of the United States Department of Agriculture shows a very great increase in the value of farm animals during the past few years. This is also true in Pennsylvania. Never before in the history of the State has there been a greater demand for draft horses for city use, mules for the mines, dairy cows and the meat-producing animals to supply cream, butter and meat for our tables.

The Agricultural Report for 1908 shows number, average price and value of horses, and mules on farms in Pennsylvania, to be as follows:

Horses, 619,000; average price, \$116; value, \$71,804,000.

Mules, 43,000; average price, \$128; value, \$5,504,000.

It is impossible to estimate the number of horses shipped into Pennsylvania annually. Philadelphia, alone, requires about 7,000; other large cities in proportion. Most of the imported horses come from west of the Missouri river. They are bought and shipped to Indiana and Illinois; fattened, resold and shipped to the Eastern states.

Many of you, no doubt, remember the map of Pennsylvania exhibited by the Livestock Sanitary Board, at our meeting last January, showing the number of pure-bred and grade stallions in each county. According to the map, we find 664 pure-bred and 1,303 grade sires—two grades to one pure-bred.

The following counties have a larger number of pure-bred than grade stallions:

	Pure-bred.	Grades.
Allegheny, -----	18	10
Crawford, -----	56	50
Greene, -----	22	18
Lawrence, -----	31	14
Mercer, -----	49	22
Montgomery, -----	9	7
Philadelphia, -----	7	6
Washington, -----	33	25
Westmoreland, -----	48	27
Making a total, -----	270	179

These nine counties, with the exception of two, are in the western end of the State. It seems as though the horse breeding industry was moving west.

Is it any wonder Pennsylvania is a great horse-importing State? With the exception of a few counties, most of the horses come from other states and this, too, in territory which is naturally adapted to the production of the highest type of horses, with a good market at hand. The Western farmer sees the importance of using a pure-bred sire on their native mares and keeps on breeding in the same line.

Your Committee would recommend to the farmers of Pennsylvania that they grow more horses and better horses, that they breed their native mares to pure-bred sires and the offspring to a sire of the same breed. Let one be a Percheron community, others Clyde or Shire. Buyers will soon learn that by going to a certain locality they will have a greater number to select from, and of a more uniform type. All grade stallions are not inferior breeders, but many of them are. They not only do harm in getting inferior animals, but they drive the good horse out of business by their low service fee. Under the present law every breeder can know whether he is breeding to a grade or pure-bred sire, and this knowledge should enable him to discriminate to his own advantage, and the betterment of the horses of this State. Why are we content to produce cheap horses when, with the same feed and care, we can produce good ones, which will sell for larger prices and give the breeder greater satisfaction.

Some reasons why Pennsylvania farmers should breed more horses:

1. They are acclimated and ready for work.
2. They will bring higher prices on the market.
3. They will pay for feed consumed after two years old by work done on farm.
4. You can make money at it.

farmers. Very few of our dairy farmers are growing enough animals to fill vacancies in and increase the size of their herd. They should rear the offspring from their best cows. The average cow in Pennsylvania yields less than 150 pounds of butter per year, not enough to pay for feed consumed, and these are the kind you find for sale, while a calf from the best cow, reared on the farm will be accustomed to the surroundings and treatment, and when she grows to be a cow, will do her best.

In all branches of livestock industry in Pennsylvania, the general purpose idea is too prevalent. It has been demonstrated time and again that you cannot have beef and milk nor speed and heavy draft in the same animal. A very striking illustration of this is shown by the lectures given on the special dairy train in Indiana last December. The lectures were systematized and condensed by the use of valuable charts. A most striking illustration was used to show the value of a pure-bred dairy sire. The records of three animals in a farmer's herd were tabulated on a chart. One record gave the production of a grade cow. This record amounted to 3,085 pounds of milk and 137 pounds of butter for the year. Selling butter for 25 cents per pound, the income amounted to \$34.19. The next record gave the production of a daughter of this cow that was sired by a pure bred Jersey bull. This cow produced 6,000 pounds of milk and 280 pounds of butter in one year, making an income of \$70. The third record gave the products of another daughter sired by a pure-bred Shorthorn bull. This animal made a yearly production of 3,700 pounds of milk and 155 pounds of butter, giving an income of \$38.85. Comparing the records of the daughters with the record of their dam, it was shown that the half-blood Jersey made an increase of 143 pounds of butter over her dam and an increased income of \$35.81. The increase made by the half-blood Shorthorn over the dam was 19 pounds of butter or an increased income of \$4.66. Assuming that a Shorthorn bull is used in a herd of ten cows and the heifers from these cows do as well as the half-blood mentioned, the increased income per year would be \$46.60. If a Jersey sire were used in a similar herd, the increased income would amount to \$358.10.

This illustration shows very strongly the importance of using a pure-bred dairy sire. The result would have been as marked had they bred along beef instead of dairy lines. The average farmer in Pennsylvania can, with very little expense, improve his native herd by using a pure-bred sire of either beef or dairy type.

There are on Pennsylvania farms 1,135,000 sheep valued at \$5,108,000.00, 990,000 swine valued at \$8,415,000.00, yet our State does not produce enough livestock for the requirements of its population. At Pittsburg yards alone the number sold for consumption in 1909 were, cattle, 114,006; swine, 663,925; calves, 86,651; Sheep, 369,801. They report that receipts of all livestock were unusually light and the average year will enlarge the figures on cattle, sheep and calves 25 per cent., and on swine probably 40 per cent.

Aside from all this, there are annually brought into this State, thousands of dressed carcasses, as well as large quantities of manufactured products and cured meats. It would be impossible, at least at present, for Pennsylvania to supply the demands of livestock products; but, I believe, we are able to increase the numbers and the

quality of our livestock, and by so doing, we will be rewarded financially. The farmer who breeds good stock is a public benefactor. As he wields his influence for good, his stock will be an incentive for others to follow in his footsteps. Thus the work moves on and the world is better for his having lived in it.

REPORT OF THE COMMITTEE ON LEGISLATION.

By H. G. McGOWAN, *Chairman.*

Your Committee on Legislation, through this report, will endeavor to carry out the spirit of legislative demands of the State Board of Agriculture, rather than be responsible for its own formulated ideas concerning new legislation. However, there are some points along legislative lines that might be suggested, but your Committee in particular would emphasize those demands for legislation suggested by the present State Board of Agriculture, in preference to what we might hereafter particularize.

Since our last annual report, another session of the legislature has passed into history, and we are sorry to say that a very small per cent. of the requests made upon that legislature passed into law. For what we did get we feel grateful to those who lent their assistance; but we felt then and do now, that we asked for nothing but what was fair, just and equitable under the circumstances. We felt particularly sorry that the appropriations for local rural roads fared as badly as they did. It was a fair bill, but it was amended and mangled until we got nothing but the corpse. The same is true of other bills.

To the recommendations we will make herewith in the form of suggestive resolutions, we invite the thoughtful consideration of every member of the Board.

TAXATION.

WHEREAS, By the last available report of the Auditor General, the inequalities of taxation in Pennsylvania are plainly shown by the following *astounding* figures:—

"The aggregate appraised value of real estate in Pennsylvania is \$4,172,955,443.00.

The taxes paid by real estate is \$69,881,707.00.

Average rate of taxation on real estate, 16 mills.

Appraised value of personal and corporate property, \$6,511,485,-
670.00.

Resolved, That, inasmuch, as, by the action of the last Legislature, there now exists a Commission for the Codifying of our Tax Laws, this body demands that the real estate owners and organized farmers of Pennsylvania be given hearings before this Commission, and that this Commission be urged to weigh carefully the recommendations of these real estate representatives.

WHEREAS, We believe that a great help toward the equalization of taxation is found in the proposition of having the State pay the minimum salary of school teachers for the minimum school term; be it

Resolved, That we urge the recommendation of such law by the Tax Commission and its passage by the next Legislature.

We would present the following as a part of our report, and urge the adoption of the recommendations contained therein:—

If personal and corporate property were taxed at the same average mill rate that real estate would be taxed, personal and corporate property would be required to pay \$43,696,483.00 instead of \$19,824,964.00.

Crediting to personal and corporate property commissions, licenses and other miscellaneous sources of income, amounting to \$11,000,000.00 would make a total of \$54,696,485.00 as the share of personal property.

If taxes were collected equitably, real estate would be required to pay \$35,052,825.00 instead of \$69,881,707.00, or a saving to the real estate owners annually of \$34,828,882.00.

The real estate owners are, annually, grossly robbed of \$34,828-882.00. Fifteen millions of this amount is directly extorted from the farmers and nineteen million from residents and towns, whether they be owners or tenants. It is this policy of the State that has driven away from the farms and rural communities, according to the last census report, over one hundred thousand people from twenty-two counties of the State.

To correct these discriminations against the farm and home owners of Pennsylvania, we respectfully insist that the State either assume a larger proportion of the cost of the local government, or give the local governments authority to tax personal and corporate property in each unit of government.

The State could, without any detriment to its own finances, remit to the counties the \$9,716,700.00 now collected by the State from the counties. And in all justice, the State should pay the minimum wages of public school teachers, for the minimum term, which would assist the local governments upwards of \$13,000,000.00. And could further relieve the local governments by appropriating a minimum sum per mile to the counties and townships for road purposes equal to fifty per cent. of the road taxes paid each township; limiting the amount to \$20.00 per mile, and relieve the counties and townships of the partnership business in constructing State roads. Let the State assume with the aid of the National Government the entire construction of inter-state and inter-county roads.

If there are not sufficient revenues for the State Government, an additional tax of one mill could be placed on all personal and corporate property (without any hardships) with a small tax on the gross productions of mines, oil and gas wells, and similar enterprises.

Besides, there are numerous other sources from which revenues might be derived.

If the State treated the agricultural class with justice and equity the farmers would be contented in their vocation, and Pennsylvania would have more prosperous and happy agricultural communities, which are the mainstay of the prosperity of our Commonwealth.

GOOD CANDIDATES WANTED.

WHEREAS, In scanning the *personnel* of our Legislature there is no trouble whatever in picking out the farmers and those in sympathy with the farmer and his industry and counting them upon our fingers; and

WHEREAS, Recent history has taught us that the long promises of the candidates who truckle for the farmers' votes fall short in fulfillment; be it

Resolved, That we urge all farmers to get out to the primaries and vote for the candidates for legislative and executive offices, upon all party tickets, whom we know will stand for our propositions; and

Resolved, That we do not scatter our ammunition, but urge the farmers in every county to center upon certain men in all parties and see that they are nominated.

INITIATIVE AND REFERENDUM.

We would especially urge careful and thoughtful attention to the following preamble and resolution:

WHEREAS, We believe that misrepresentation will continue and unrepresentative laws be passed just so long as our representatives have no more to fear than defeat at the poles, and this made remote by corrupt election methods;

Resolved, That we advocate an amendment to the State Constitution which will give us the initiative and referendum in a workable form; and

Resolved, That we urge all candidates for the Legislature to pledge their constituents to work for the submission of this proposition to the people, if elected.

STATE FAIR.

We believe that our farmers are much interested in the passage of

EXTERMINATION OF WEEDS.

We believe that a general law looking toward the extermination of foul weeds throughout our State is greatly needed. Such a law should make it a misdemeanor for any person to sell grass seed containing the seeds of foul weeds. It also should be made the duty of land owners to prevent certain foul weeds from seeding on their premises and the duty of Supervisors to prevent the seeding of said weeds upon public highways. More vigilance upon the part of the farmers is urged upon this line. Carelessness and untidiness in business brings failure and disappointment, and indifference in allowing the various foul weeds to grow without being checked, reproducing millions of seeds, is a hurtful habit, if not a sin, perpetrated upon the intelligence of the American farmer.

A law should be in vogue compelling seed dealers to label the bags as either strictly pure or as containing a percentage of inferior seeds. Such a law, also, should make pure seeds to be absolutely free from inferior seeds.

THE STATE COLLEGE.

It has been made apparent by recent developments that the School of Agriculture at the Pennsylvania State College is inadequately equipped for the most telling work. A building designed to teach the great work of Horticulture is needed there and we would recommend to the next Legislature that an appropriation for such building be made and that sufficient appropriation for all of the work of the Agricultural School at State College be given the Institution.

OUR STATE DEPARTMENT.

We feel that it is incumbent upon us in this report to recognize the efficient work being done in our State Department of Agriculture. The farmers of Pennsylvania are benefited materially by the work of this Department, and we would urge that all Pennsylvania farmers familiarize themselves with the work being done here and lend all assistance in their power to furthering this work.

Pennsylvania has one of the best oleomargarine laws in the country, and the work of prosecuting the illegal sale of oleomargarine is persistently done by the Department. We would recommend, however, that less care be taken for the raising of revenue through fines and licenses than for the extermination of the traffic in colored oleomargarine. The fraud in oleomargarine is in the coloring of it, and our Pennsylvania State law fully covers this fault.

Resolved, For the further stimulation of agriculture, which is the foundation of all our material wealth and prosperity, we would recommend that agricultural societies, instituted for the spreading and development of agriculture, owning their own properties and holding annual fairs, be exempt from the burdens of taxation, as this would greatly assist and relieve much embarrassment.

In conclusion, we would, to the best of our ability, impress upon the farmers of Pennsylvania the necessity for increased vigilance in zealously guarding their profession from the attacks of the outside interests that are parasites upon the productive body.

We believe that the proper position of the agricultural industry cannot be secured until the farmers get together through their own organization and demand the passage of laws that are fair and the election of men to executive positions who are not biased in favor of the interests which prey upon the people who produce.

We believe in improved methods in agriculture and know that the productiveness of our farms should be and must be increased; yet we also feel that it is not by method that the farmer will come into his own as a producer and a real part of our social and business scheme, but by legislation and the proper execution of well meant laws.

We have but the kindest feeling for the workers in other walks of life, be they bankers, merchants, doctors, lawyers, or what-not, so long as they are fair and inclined not to extort, but we do feel that the farmer should stand on the same plane with other professions and be accorded the same hearing. It is possible for the farmers to have all that belongs to them, and it is their fault if they do not get it.

Respectfully submitted,

(Signed) HOWARD G. McGOWAN,
S. S. BLYHOLDER,
MATTHEW RODGERS,
A. J. KAHLER,
E. B. DORSETT.

FOUR ESSENTIALS OF SOIL FERTILITY.

By PROF. ALVA AGEE, State College, Pa.

There are only four essential things to consider in converting all the thin fields, between the Mississippi River and the Atlantic seaboard, into productive land. The first one is drainage. Much of our land has natural drainage and this problem does not enter. Other land is wet-water soaked. We know what that means. Air cannot enter to help make the inert plant food available. Friendly bacteria cannot work for us. Roots will not penetrate into the stagnant soil. We cannot plant in season nor cultivate as we should. The soil is water-sealed when we want it to be active. Such land must have drainage.

Usually we should underdrain and tile is the best material, but each man may solve the problem in his own way. If surface tiles will

The second requirement is that the soil be sweet. Very much land is acid. The area grows greater year by year. The acid condition is unfavorable to many kinds and notably so in the case of the clovers. Low wet land and high sandy land may be sour. Infertile land in the eastern half of this country usually is sour. Do not waste time arguing the point with men whose land does not need lime. Let them believe as they may; no harm can result because their soil is sweet, but lime your own land if it is acid and do it quickly. This is the second essential and there is no way of getting around an essential.

Probably all land in our Eastern States will become acid some day if no lime is applied. Lime was put into soils when they were made and is its natural tendency to get out of soils. When there is not sufficient lime in available form to combine with the acids that continually are forming in soils, the result is an accumulation of free acid that is harmful to most plant life. While some soils of Pennsylvania had a scant supply of lime in their making and are now so acid that clover refuses to grow, we have large areas of limestone soils that have ceased to be sweet and clover is quitting. An application of lime to keep soils alkaline is essential to profitable crop production.

One year ago it was my privilege to discuss this phase of the soil fertility problem before this body of men, and it is hardly proper that I repeat what was said at that time. The use of lime in a rational way to keep soils sweet is the biggest consideration in the agriculture of this day.

The third consideration in the improvement of soils is organic matter. If there were an abundance of manure on all farms, this factor in soil building would need little consideration. When the manure were rotted in the soil it would improve the texture of the ground, assist in holding moisture, and add plant food. But there is not one-tenth enough manure to keep all the land supplied with organic matter, and dependence must be placed upon plants. We may get the material from their roots and stubble, as is usual in case of the clovers and grasses, or from the entire plant. When the supply of manure is light it pays best to use it to grow heavy sod for plowing down.

We have learned that big returns may be obtained from a very moderate top-dressing of grass and clover fields immediately after hay harvest. The manure doubles its efficiency by making a heavy growth of roots and aftermath to be used for feeding succeeding crops in the rotation. The making, saving and application of manure affect farm incomes greatly and a lot of skill is possible. Organic matter in the soil is the big consideration, and manure can be made to supply as much indirectly as it does directly.

There is a limit to the amount of stable manure that may be made, because there is a limit to the amount of soil products that should be furnished the human race in the form of animal products. Our chief need is better care and use of the manure now made. But there would hardly be a limit to the supply of organic matter for soils from the clovers, if we would meet the conditions for successful clover growing. On two-thirds of the land from the Mississippi River to the seaboard there has been a tendency to accept the idea that the clovers can not be made to grow successfully.

In the Northern States the varieties in common use are medium red, mammoth and alsike. They have been failing more and more and land has grown deficient in organic matter and less productive. There are limited areas in which disease has caused failure, but in the vast majority of cases the inability to grow clover can be overcome. Drained land, made sweet with lime and given proper applications of fertilizer, can be brought to the production of heavy clover sods. Some doubt the statement, but within the last few years the certainty of it has been established by thousands of men on all kinds of soils. We can get the clover, and it does not pay to doubt the fact.

Medium red clover is a great soil-builder when given a chance. It produces two crops, and we can harvest one of the two without any great injury to the soil. This may be the first crop, the second crop being plowed down. Or, we may clip the first crop twice, making rich mulches, and then take off a crop of seed. When we take both we rob the land of organic matter unless the manure comes back to it. Medium red clover also makes a big growth of roots. When a soil is not water-logged, and has been sweetened with lime, medium red has no superior in ability to build up fertility.

Where drainage is less good, and where there is some deficiency in lime, the alsike is surer. It does not equal medium red or the mammoth as a soil-builder, nor does it make as much hay per acre, but it is excellent nevertheless, and a good plan is to mix alsike and red when seeding doubtful ground. The alsike seed is small, and a mixture of one bushel alsike to five bushels medium red is good.

The mammoth makes only one crop. It makes coarse hay and falls badly when seeded alone. It is a good mixture with timothy, ripening later than the medium red. The latter is the better for fertility if its second crop is left on the ground.

It would be great if crimson clover could be grown throughout the Northern States. It is a winter annual, like wheat. If it were a hardy plant, our Northern States would have the best possible winter cover crop. If people inoculated the soil for it, as they do for alfalfa, the day would come when much larger areas in the North would grow this clover with success.

The grasses can furnish a large amount of organic matter to land, and would be soil-builders if used aright. The chief trouble is that we do not fertilizer grass sods so that they will be heavy, and do not plow them down when heavy. We use them to skin the soil rather than to build it up. A heavy grass sod, turned under with

between the Mississippi River and the Atlantic seaboard discloses the nearly universal need of phosphoric acid in our soils. When land has drainage and lime and is not producing satisfactorily, it is a safe assumption in Pennsylvania that phosphoric acid should be applied. When the requirement for this element has not been fully met the results from applications of nitrogen and potash are sadly limited. A pretty good rule is to meet the requirements of the soil for phosphoric acid in a liberal fashion and then to inquire further into the soil's needs. Where organic matter is used in liberal amount and thoroughly good tillage is given, we may find that phosphoric acid alone will insure quite satisfactory returns from the land. It is the rule, however, that when the soil requirement for phosphoric acid has been met, applications of potash begin to pay and applications of nitrogen are wholly profitable, even at the present high price of nitrogen, unless stable manure or heavy clover sods are freely used. It is poor policy to put labor and seed upon land that is left deficient in available plant food. If we have reason to believe that there is not a sufficient amount of nitrogen to produce a heavy leaf growth of dark color, it is good business to buy the nitrogen in a commercial fertilizer if the crop is to be planted. The grower of staple crops will plant to secure larger supplies of nitrogen in the immediate future through the use of legumes and stable manure, but he will not get away from the use of phosphoric acid and possibly of potash, and as the years go by the application of these mineral elements will become greater.

I have sought to present in a simple way the four principal considerations that present themselves to an experienced man who looks over a thin soil that he wishes to put into productive condition. He thinks first of drainage; next, destruction of harmful acids through the rational use of lime; thirdly, rotting organic matter that is the life of any soil, freeing natural strength and making land retentive of moisture; and lastly, the application of immediately available plant food, both to produce organic matter and to supplement the natural forces in the worn soil. The man who centres his attention upon these four considerations and meets the requirements in a practical way can hardly fail to solve his problem.

REPORT OF THE ORNITHOLOGIST.

By PROF. H. A. SURFACE, *Harrisburg, Pa.*

It is the duty of your Ornithologist to give an annual report upon the subject of ornithology and kindred subjects, as seen in this State during the year 1909. It has not been a year marked by any remarkable or unusual features in bird study, but some of the year's bird features are worthy of our attention. In looking over the correspondence of the Economic Zoologist we find some indications of popular thought on the following points:

1. On January 5, 1909, Miss Marian Gunnison, Erie, Pa., desired information concerning the establishment of a branch of the Audubon Society.

2. On March 26, 1909, Miss Mary I. Graves, Susquehanna, Pa., observed a Bird Day in her school, and desired information concerning the establishment of an Audubon Society.

3. On March 29, 1909, Mr. Howard J. Kuntz, Erie, Pa., wrote to us concerning the establishment of a bird club. Mr. John M. Phillips, member of the State Game Commission, of Pittsburg, Pa., was referred to as a good person for Mr. Kuntz to consult. Mr. Phillips offered a prize to everyone who got a bird to nest in a bird box, which he had made for this purpose.

4. Mr. Rodger Harvey, Coudersport, Pa., on May 12, 1909, desired information concerning the economic features of hawks, owls, crows, cowbird. Bird publications were also desired.

5. Mr. B. S. Bowdish, New York City, on July 29, 1909, asked for opinion on reports of birds killed by spraying.

6. Mr. E. M. Handwerk, Germanville, Pa., on June 21, 1909, wrote to us concerning blackbirds and crows pulling corn.

7. Mr. Christian Krier, Bethlehem, Pa., wrote on June 12, 1909, asking that a law be passed changing the present law concerning protection of blackbirds because they destroy corn.

8. Mr. H. B. Richardson, Beaver Falls, Pa., on March 13, 1909, sent us a specimen of Morning Dove

9. Mr. William Smith, Hazleton, Pa., wrote concerning English Sparrows as scavengers.

10. Mr. R. W. McDowell, Uniontown, Pa., wrote on January 4, 1909, that he has been successful in colonizing Purple Martins around his premises. He expects to furnish us with an article on the subject, describing his methods.

11. Mr. J Warren Jacobs, Waynesburg, Pa., on April 30, stated that he is making and selling bird houses in different localities.

12. Mr. G. H. Williams, Blossburg, Pa., on February 3, 1909, sent us a specimen of female Pine Grosbeak. He stated that they are quite tame.

In further discussion of these points we wish to report as follows:

First, there is an increasing demand for information in bird study and upon the subject of the formation of Audubon societies and bird clubs, and also the establishment of "Bird Day" in schools. If persons interested in this will write to Mr. Frank E. Chapman, Editor of Bird Lore, American Museum of Natural History, New York City, or to Dr. William Dutcher, 141 Broadway, New York City, or to Dr. Witmer Stone, Academy of Sciences, Philadelphia, they will be able to obtain information of the kind desired. They can learn the purpose and methods of establishing a Bird Day in the schools and of calling the attention of the pupils in the public schools of our State to the ethical and economic features of our native birds. It seems very necessary that the birds be preserved, and that sentiment be created and maintained for their preservation. This can not be done better than in the public school, while the mind is in its formative process.

Concerning reports of birds having been killed by spraying, we must say that we have had considerable correspondence with Dr. E. H. Forbush, Ornithologist of the Massachusetts State Board of Agriculture, on this subject, and he is of the opinion that this does not occur excepting where the caterpillar might be recently loaded by eating poisoned plant tissue, and the poison not having yet taken

effect upon the larva or "worm." At such a time there would be at least a chance of its being eaten by a bird, with injurious effects upon the latter. However birds do not eat sickly nor dead insects, and, on the whole, we must surely say that spraying is far more beneficial than injurious in its results, and it is not our opinion that the reduction of our insectivorous birds in numbers is due to any noteworthy extent, whatever, to the modern and commendable practice of spraying with arsenical poisons to destroy chewing insects and prevent fruits from becoming wormy.

Concerning crows and blackbirds pulling corn, we must, unfortunately, report that it has been our own experience to lose a small tract of corn by the ravages of the blackbird and, of course, we are therefore in condition to be personally prejudiced against this species, although careful analysis of the situation shows that most of the corn pulled was infested with cutworms and was probably pulled for the sake of obtaining these insect pests. A remarkable case of this general kind, where the robin was detected in the act of pulling cabbage plants, and was found to be engaged in the work of eating maggots or larvae which infested the roots of the plants, was reported in the Monthly Bulletin of the Division of Zoology, and was also mentioned in a previous report of your Ornithologist. It is interesting to note that in the annals of Economic Ornithology the report of this particular occurrence has become classical, and has been published as a leaflet by the National Association of Audubon societies. It is still an open question whether the blackbird should be destroyed in the cornfield. If they can be driven away and preserved during a short time, it will save the corn and also retain them for future beneficial services, such as we know they do perform.

The remarkable success of the efforts of some persons to colonize the Purple Martins around their premises is one of the features of bird preservation and observation for the year which deserves special mention. Several persons erected bird houses according to plans previously published by the Division of Zoology of the Department of Agriculture of this State, and reports have reached us to the effect that such efforts have in many cases not been in vain.

We have one very interesting report of the Purple Martin having been driven away by honey bees. This and our reply is as follows:

"R. D. No. 1, Bangor, Pa., January 10, 1910.

Prof. H. A. Surface, Harrisburg, Pa.

Dear Sir: A little over a year ago I built a bird house for the Purple Martins, according to directions in one of your Bulletins, with some 20 rooms in it, and raised it on a pole to the proper height from the ground, and kept it clean from sparrows' nests. In the Spring of 1909 some Martins came and flew around this house at many different times, and even alighted on it to look around, but every time they went away again. Under this house, about fifty feet or so away from it, I have three colonies of Italian bees, and it seems that the bees drove the Martins away, because I and my wife watched several bees flying about the birds, and they seemed to have a fright. We noticed a Martin darting and screaming for several minutes at a time, with the bees right after it. Now the question is this:

(1) Will the bees drive away or prevent the Martins from occupying my house?

(2) Will the Martins eat my bees if I should establish a colony of them?

I don't want to give up the bees, and, also, would like to have the birds. I will feel very much obliged for an answer. Thank you for help in the past.

Yours respectfully,

(Signed)

R. No. 1, Bangor, Pa.

(Reply)

January 13, 1910.

My Dear Sir: Replying to your very interesting letter concerning your experience with Martins and bees, I beg to say that it is my opinion that the Martins are very alert when searching for nesting places, and anything that would disturb them, would tend especially at that time to drive them away, as is the case with other birds. While I think the bees would become accustomed to the Martins and not continue to attack them, yet I have no doubt according to your description, that the bees would molest the Martins just at the critical time when the birds were deciding whether or not they should remain there. I do not think the Martins would eat the bees should they become established, and I would offer the suggestion that possibly the bird house was in the line of flight of the bees, and thus more readily discovered and attacked.

I would suggest that the hives be turned around so that they will face from the bird house, and possibly be placed back of some shrubbery so that the bees will not see the birds as they come and go. This entire condition is unusual but not impossible; and while I cannot prove it, yet I believe that this interpretation is correct, and that these suggestions will be found practical.

Very truly yours,

(Signed) H. A. SURFACE,
Economic Zoologist."

The Purple Martin is one of the most valuable insectivorous birds, feeding while flying, and not known to have any objectionable features, excepting, possibly, that of littering the ground under its nesting place. We are interested in knowing that one person in this State is conducting an extensive business in manufacturing and selling bird houses, adapted specifically to the needs of this bird, which could be so well protected and induced to colonize around the premises where suitable arrangements are made for it.

The barn swallow is another bird worthy of careful preservation. Many of us remember when at least two species of swallows used to make their nests beneath the eaves of the old farm barn, and were

what resembles the bedbug. This, however, does not spread to mankind nor to livestock, and, therefore, does not form any basis to justify their destruction.

The quail or "bob white" is becoming more rare, and should be given every reasonable protection. It is one of our most valuable insectivorous birds and seed-eaters, being a beautiful and attractive bird, and of such economic value that the farmer cannot well afford to do without its services. We, of course, recognize the fact that the necessity for the destruction of certain pests, especially insect pests, is annually engaging more and more of our attention and involving greater expense. How often do we forget the services of the seed-eating birds, such as the song sparrows, the quail and the dove. The song sparrow alone renders us a service which is estimated to be not less than tens of thousand of dollars annually in this State, in the destruction of weed seeds, which otherwise would be liable to spring up and become the foe of a cultivated crop.

The closed period (of years) for quail is advocated, and rightly; but it does not seem to meet the needs. What we need is funds in the hands of the Game Commission for the propagation of the quail, and adequate laws for its real protection during vigorous winters. To prevent the hunting of the quail during the fall, but permit them to be snowed under or starved by prolonged covering of ice and snow, such as we see this winter, means the destruction of more quail by the second method than by the gunner. Surely we are more guilty of the crime of omission or neglect than we are of commission, for the reason that it involves the destruction of more of the beneficial creatures about us.

In this regard we must call the attention of the public, especially to the farming people, to a very important subject: the Gun License Law. This is outlined in the October Bulletin of the Division of Zoology of the Pennsylvania State Department of Agriculture. This outline was furnished by the State Game Commission for the purpose of acquainting the public with the provisions of the proposed legislation. Among these are the following:

1. The gunner to pay a license fee (perhaps fifty cents or a dollar) for carrying a gun or hunting, excepting on his own premises.
2. No person under sixteen years of age is permitted to carry or handle a firearm at any time.
3. Unnaturalized foreigners debarred from carrying or using firearms.
4. The gunner get written permission of any land owner before entering upon his premises, although this may be good for any length of time for which the owner may see fit to give it.
5. He must carry his license with him, and be willing to submit it to the owner, lessee, tenant or employee of the owner of the land on which he hunts. This will give his name and address, and make it possible to identify any person guilty of misdemeanor.
6. The owner, tenant, lessee, employee or person employed by the owner is authorized to forcibly arrest at once any person refusing or failing to produce and exhibit his license at their request.
7. The money collected as fees is to be put into a fund for the purpose of game protection and propagation.

The provisions of this law meet the present inadequate laws in making it impossible for one to trespass on another's premises, without the written consent of the owner, and this also obviates keeping the

premises posted. We know how difficult it is to keep signs of the exact legal wording, especially where the gunners will see them frequently and will shoot them or destroy them, and the owner cannot watch against their destruction. According to the present law if a poster is not worded exactly correct, saying, "THIS IS PRIVATE PROPERTY," etc., it is not a legal warning for trespassers to keep out. Also, the farmer has no means whatever of learning trespassers' names, and no means of arresting them without a warrant. This makes it very easy for the town hoodlum to run over their premises and engage in killing fowls or robbing fields or orchards of their contents, and if he is observed, he can disappear before his name can be learned or before he can be arrested. The proposed law affects no hardship on the farmer's boy, because he is permitted to hunt on his own premises.

Another feature of the case is, that it will provide a needed fund for game propagation, and will make it possible to protect properly our insectivorous birds, as well as those that are generally called game birds. If game were known to be abundant in any part of the country, there hunters would go in numbers, and would become acquainted with the country people and leave their good money behind, just as persons now go for pleasure or recreation to the watering resorts or other places, and spend considerable money in the quest of recreation.

Under the heading of bird protection, we must not fail to call attention to the warning issued by the Game Commissioner concerning the effects of permitting cats to run wild and half fed, or not fed at all, when they will be almost sure to form the habit of hunting and killing birds, and will prove very destructive. While the cat is a most beneficial creature if properly kept in place and in check, yet we must remember that there are limits of profitable increase, and no person should permit the cats, however beneficial they may be in granaries, storage rooms or barns, to increase in such numbers that, in order to obtain food, they must kill birds, which are of great value and worthy of every effort we can make toward their protection.

To protect birds' eggs and nests from destruction by cats and squirrels, especially little red squirrels, as well as serpents, we recommend placing a band of tin one foot or more in width about each tree in which the birds are observed building their nests in the springtime. If there are two or more trees in a clump whose branches intertwine, it is, of course, necessary to band all of the trees of the clump to prevent squirrels from reaching their nests.

In conclusion, I need but call attention to the increasing ravages of insects, due certainly in a great part to our failure to give proper attention to the protection and propagation of their enemies. How-

REPORT OF THE COMMITTEE ON POULTRY.

By H. M. GOODERHAM, Chairman.

It is not necessary that I take your time in telling you the amount of worth in dollars and cents "Biddy" is producing in the United States or in this State, nor is it necessary for me to tell you that the poultry product turned into money in this country is equalling or worth more money than the wheat crop, etc., etc.

But with all the great wealth she is producing, or work she is doing, let me turn your attention to the markets of this State and listen to the cry of the consumer for more eggs, fresher eggs, as well as more and better poultry for the table. When I stand near the wharfs in some of our towns and cities in this Commonwealth and see boat loads of chickens and eggs unloaded, as well as standing near freight stations and express offices, and see box loads as well as car loads of the same product unloaded, and not any of it produced or bought from the farms in our great Keystone State, I cannot refrain at this opportune time from drawing the attention of this Board to the many thousands of hens of this State that have not laid an egg this winter, but are standing in some poorly ventilated, dirty, filthy, lousy coop eating their feed from an old pan or trough or from an ill-kept floor, waiting for Spring to arrive that she may get out and nearer to her natural conditions and start on the work of reproduction.

I am not speaking that I may discourage you, but rather as words of encouragement. If you travel over this State you will find one farmer in about every twenty-four whose hens are doing excellent work throughout the year; but you, as members of the Pennsylvania State Board of Agriculture, whose work it is to help to advance agriculture, about three hundred days in the year might, at the time of our County Institutes or at other times, try and get the twenty-fourth man who is making a success of the poultry business to show the other twenty-three of his community, not only where the mistakes are, but how his success has been accomplished. This work could be done in addition to the good work which is being accomplished by the Department of Agriculture and our Farmers' Institutes.

Fresh air, ample sunlight and a well balanced ration are the fundamental principles of good egg production. Have good stock, always bred from the very best ancestral types until you attain the form, vigor, laying powers and market types desired. Stick to one form of fowls, have well ventilated, sun-exposed houses. Avoid mites, lice, pests and diseases by training your fowls to out-of-door habits. Do not pamper them by indoor treatment. Many chickens die from want of fresh air, fresh water, over-feeding, injudicious feeding of young chicks, by permitting them to have access to all sorts of dead, diseased and impure or filthy food. Train your fowls to be cleanly in habits and busy in out-door search of food.

The laying hen is always abroad early in the morning and lays her egg before mid-day. The manure from the hen properly cared for will more than repay for the cost of her keep for a year; hence, eggs cost you nothing from such a practice. Hens will lay, if properly bred, fed and cared for. It is as natural as life for them to do so. Not to lay and not to be busy is an abnormal condition. Caponize your cockerels. It pays. Percentage of mortality in caponizing is small when the art is understood. Do not feed new wheat to chickens. It sickens and kills them. Late molting in the fall is the result generally of being too busy laying eggs. Whitewash, disinfect and, best of all, fumigate your hen houses once or oftener in a year. Have few window-glass in your hen houses. In a great many instances you should have them open, save a curtain of good ducking, which can be lowered for emergency. Study poultry house construction and use good, solid, clean new yellow pine boards or good cement for flooring. Build the best houses. They are the cheapest in the end, and will last a long time. Feed boiled oats, pearl millet seed, cracked foods. Avoid too much yellow corn, save when fattening. Provide good sharp grit, preferably finely crushed and screened, and plenty of oyster shells. Fowls must have grit and oyster shells both summer and winter. Get pure bred stock and stick to the fixed type until you have traced out and fixed the quality. In turkey raising, let them sleep out of doors. Don't feed corn. Keep the best, most vigorous stock to breed from. A very good, perhaps, somewhat expensive feed, is raw egg stirred and stale bread intermixed. Do not feed hard boiled eggs. It's not wanted by baby chicks or turkeys.

I advise farmers of this State to pay more attention in detail to chicken and turkey culture. Market poultry and eggs are destined to go yet higher in the market and remain there in future years. Study your business well and stick to it until you succeed. Perseverance brings success in any business.

It is claimed that the sum of \$5,798.00 is received to-day in Petaluma, California, from the sale of poultry and eggs. For the year 1908 the total receipts were \$2, 116,604.00, divided as follows:

Eggs shipped,	\$1,726,601.00
Poultry,	332,544.00
Baby chicks,	57,459.00

There are 1,808,436 hens kept in the vicinity of Petaluma.

Conservative figures place the estimate of eggs laid last year at 8,403,638 dozens. If all the hens in Petaluma Valley were to roost together in one straight line, it would make a poultry line of ninety-five and one-half miles in length. If a house were built for them with three rows of roost running lengthwise, it would need to be almost thirty-two miles long.

I only cite Petaluma, California, as one of the many places in this United States where money is being made in poultry, and I hope

THE PRINCIPAL LIMESTONE DEPOSITS OF PENNSYLVANIA AND THEIR ADAPTABILITY TO THE MANUFACTURE OF PORTLAND CEMENT.

By BAIRD HALBERSTADT, F. G. S., Mineralogist, Pottsville, Pa.

The increase in the production of Portland Cement in the United States within a decade has been phenomenal. From an annual production of 5,652,266 barrels in 1899, the production has increased to 51,072,912 barrels in 1908, or, in other words, more than nine and two-tenths (9.2) times as much Portland Cement was produced in 1908 as in 1899. During the same period a decrease in the annual production of Natural Cement has taken place. Of this cement, there were manufactured 9,688,179 barrels, while in 1908 but 1,686,682 barrels were produced.

The manufacture of Puzzolan or Blast Furnace Slag cement likewise shows a heavy decrease, for in 1907 its production is reported as being 557,252 barrels, while in 1908, this had been reduced to 154,451 barrels. Since the first slag cement was produced in the United States the production has fluctuated. While, perhaps, it is not fair to compare the figures of 1907 and 1908, for it is possible that the panic in 1907 and the resulting stagnation in business generally throughout the country had something to do with the decreased demand for slag cement, it is hardly probable, since notwithstanding the business stagnation of the country in 1908, the increase in the production of Portland Cement in 1908 over that of 1907 was 2,287,522 barrels. The value at the works of the Portland Cement produced in 1908 was \$43,547,679, that of the Natural Cement was \$834,509, and Slag Cement \$95,468. The average prices per barrel f. o. b. at works in 1908 were, of Portland Cement 85c.; of Natural Cement 49 1-2c.; and of Slag Cement 63c.

Each year finds the uses to which cement is put growing wider. Where formerly it was used on the farm only for walks, cellar floors and concrete, we now see it very generally used, not only in foundation, house and barn construction, but for troughs, silos, tile-drain pipes, box-stalls, pig-pens, milk and dairy houses, water-tanks, cisterns, fence-posts, etc. It is rapidly replacing wood wherever either can be used. Among its advantages over wood may be mentioned its durability and sanitary qualities, for the former decays, while the latter—if the mixture be properly made—increases in strength with the passage of time. From a sanitary point of view, cement is far preferable to wood.

In view of these facts, so important to the farmer, and that perchance he may have beneath his farm a valuable deposit of limestone suitable for the manufacture of cement, I have selected this topic for my Annual Report as your Mineralogist.

At the very outset it is desired to impress on all land owners that the mere possession of a deposit of argillaceous limestone is not in itself sufficient to warrant the erection of a cement manufacturing

plant, for there are other factors in the equation which are of as much importance as the limestone deposit itself, and unless these essentials are met, no plant will be financially successful.

Assuming that a sufficient deposit of raw material (*i. e.* either an argillaceous limestone or other material from which a Standard mixture can be made) is present and can be quarried at a moderate cost, much depends upon the question of cost of fuel, the freight rates and proximity to the markets. Unless all these requirements are fulfilled, financial success will not be met. Although it is not probable that the farm land owner will attempt to erect a Cement plant himself, it is possible that he may be called upon by legitimate investors, speculators and fakirs in search of deposits of good "raw material," and it is to caution the farmer against the last two named classes that I especially desire. These may excite false hope of great gain in order to filch a few dollars from the farmers' purses by urging them to have examinations and analyses made, when they know, if they be competent and honest, that under the conditions required success would be impossible.

While it is unquestionably true that Pennsylvania has been most bountifully endowed with excellent "raw material" for making Cement, and that beneath many of the counties millions of tons of argillaceous limestone adapted to this purpose exist, yet their geographical and geological positions may be such as to make it unprofitable to quarry them.

Again, its structural condition may be such that the expenses incurred in quarrying the rock would be too great to permit competition with others having more favorable structural conditions. In other words, there are many conditions that must be very carefully considered when either purchasing or selling land underlaid or supposed to be underlaid by a limestone suitable for cement purposes.

THE LIMESTONES.

The distribution of limestone deposits in Pennsylvania is very wide. Near the lower part of the geological columnar section lies a thick and very persistent limestone known as the Trenton or No. 11 limestone. Its eastern outcrop is found in Northampton county, and it is readily traced across Lehigh, Berks, Lebanon, Dauphin, Lancaster, Cumberland, York and Franklin counties to the Maryland line. It also outcrops in Chester, Montgomery, Bucks, Southeastern Adams, Fulton, Perry, Bedford, Blair, Centre, Huntingdon, Mifflin, Juniata, Clinton and Lycoming counties (23 counties). In some of these it shows a wide outcrop, while in others it may be called patchy. This

mates the ideal mixture for Portland Cement, that it is used just as it comes from the quarry. At most of the Lehigh district plants, however, it becomes necessary to increase or decrease the calcium carbonate percentage by mixing with the cement rock a rock rich in lime, or shale, when the rock exceeds or falls below the proper limit of the percentage of lime.

The next limestone deposit of economic importance, in ascending order, is that known as the Lower Helderberg (No. VI) limestone (any limestone strata found between the Trenton (No. 11) and Lower Helderberg limestones can be dismissed without further consideration), the upper member of the Upper Silurian division of the Silurian Age. It outcrops in Monroe, Carbon, Schuylkill, Lebanon, Perry, Huntingdon, Fulton, Franklin, Bedford, Blair, Centre, Clinton, Lycoming, Northumberland, Union, Montour, Columbia, Snyder, Juniata and Mifflin counties. This will give some idea of the wide distribution of the limestones of the Upper and Lower Silurian periods within the Commonwealth.

Still higher, geographically, and within the Sub-Carboniferous and Carboniferous formations in Western Pennsylvania, a large number of limestone strata exists. Some of these are not, however, persistent; that is to say, they may be present in some areas while in others their occurrence may be sporadic or entirely absent. Of all the Coal Measure limestones, the Ferriferous or Vanport limestone, the horizon of which is between the Lower Kittanning and Clarion coal beds is the most persistent, has a wider area and is the richest limestone of the entire series. This deposit outcrops in the counties of Elk, Jefferson, Clarion, Armstrong, Butler, Beaver, Lawrence, Mercer, Venango and in the northwestern corner of Indiana.

The appended table shows the number and horizons of the Coal Measure limestones of Western Pennsylvania:

List of the Principal Limestones of the Coal Measures of Southwestern Pennsylvania.*

Formation.	Name.	Approximate Stratigraphic Position.	Maximum thickness.
Dunkard formation, or Upper Barren measures.	Upper Washington limestone (No. VI).	Top of Washington formation, 250 to 425 feet above Waynesburg coal. 20 feet below Waynesburg coal.	30
	Waynesburg limestone, ---- Benwood or Great Limestone: Upper member, or Uniontown limestone. Lower member, -----	120 feet above Pittsburg coal. Over 100 feet above Pittsburg coal. 30 to 70 feet above Pittsburg coal.	18 90 30
Monongahela formation, or Upper Productive measures.	Sewickley, or Fishpot, limestone. Redstone limestone, ----- (Pittsburg limestone, -----)	30 to 70 feet above Pittsburg coal. 20 feet below Pittsburg coal.	10 12
Conemaugh formation, or Lower Barren measures.	Elk Lick limestone, ----- Ames, or Orinoidal, limestone. Upper Freeport limestone, -- Lower Freeport limestone, -- Johnstown limestone, ----- Vanport, or Ferriferous, limestone.	Midway between Pittsburg and Upper Freeport coal. Below Upper Freeport coal, Below Lower Freeport coal, Below Upper Kittanning coal. Below Lower Kittanning coal.	6 8 28 5 10 28
Allegheny formation, or Lower Productive measures.	Upper and Lower Mercer limestones.	Between Homewood and Conoquenessing sandstones.	4
Pottsville formation, -----	Greenbrier, or Mountain, limestone.	40 to 50 feet above bottom of Mauch Chunk.	3
Mauch Chunk formation, -----	Loyalhanna, or Siliceous, limestone.	Upper portion of Pocono.	30
Pocono formation, -----	Benezette limestones of Elk county.	-----	60 7

Besides the beds named in the table, there are many thin and local limestones, among which the Jollytown, Little Pittsburg, Middle Washington, and Lower Washington have been given names, but are nowhere known to be of much economic importance.

The thicknesses given in the table are the extreme maxima known to exist, and should not be accepted as likely to occur over wide areas. The average amounts in each case are probably considerably less than half those given. In distribution the thickest beds are toward the southwest, but even there they rarely exceed a few feet, and beds averaging over 20 feet are only about three in number.

No limestones of any economic importance have yet been discovered in the Anthracite Coal Measures. In the northern field, however, in the vicinity of Wilkes-Barre, four or five beds of limestone, varying from 1 foot to 3 feet in thickness, have been found, but, as has been said before, they are unimportant in an economic sense. Even though important from a geological point of view, further consideration of them here is unnecessary.

Before entering into a discussion of the requisites of a suitable mixture of "raw material" for Cement manufacture, it will not be out of place to explain briefly the origin of limestone, since it is the most

important constituent of the "raw material" of Cement and the indispensable raw material for lime, etc.

The term limestone has been employed both popularly and technically to designate any rock or rock masses which are mainly composed of calcareous material or carbonate of lime. The origin of limestones may be due, in some cases, to organic, while in others, to inorganic agencies. In the first, through the accumulation of the calcareous material of mollusks, corals, foraminifera, etc., in vast numbers, upon ocean floors which were subsequently or during the time of their deposition cemented by the deposition (chemically) of calcium carbonate from solution.

In the second case, they are due to the deposition from solution through chemical agencies, as for example, Calcareous Tufa, Travertine and cave deposits.

Limestones vary much in chemical composition and physical appearance. The variations may be so great that a limestone that is perfectly suited for one purpose may be useless for another, hence in sampling deposits great care must be exercised. Should the deposits be made up of two or more benches, each bench should be sampled and a separate analysis made, otherwise an incorrect conclusion may be arrived at. One stratum may be valuable, while others carry too high a percentage of impurities. Variations in purity may occur in a single stratum; the upper part may be impure, while a sample taken from another part may be very good. It sometimes happens that great differences in chemical composition may be found even in the layers separated from each other by even an inch or two.

A limestone which, when calcined, makes a fine lime is not in itself alone suited for making Cement, while on the other hand, good material for Cement would be unsatisfactory, if burned, for lime; for in the first it is too rich in carbonate of lime, and in the other the percentage of impurities is too high.

Still another point: Limestones are sometimes too high in carbonate of magnesia to be suitable for the manufacture of Portland Cement. If the percentage of carbonate of magnesia exceed 6 per cent., a good cement can not be made from it, for it has been found that cement made from a rock carrying that percentage of magnesium carbonate will, in the course of time, swell and cause the cement mass to crack. A too great percentage of free lime has practically the same effect. Moreover, some of the highest authorities agree that if the magnesia constituent exceed 6 per cent. in the "raw" mixture, a falling off in tensile strength will result.

The greatest fault that can be urged against the Natural Cement rock product is its lack of uniformity, hence the increasing demand for the Portland Cement, which is made from an artificial mixture. Through artificial mixing large deposits of limestone, which alone would not yield a satisfactory or even desirable product, can be utilized. Some of the strata may be too high in calcium carbonate, while in others it may be too low. Now, by intermixing these in the proper proportion, an ideal Portland Cement mixture can be obtained which, if carefully calcined and treated with equal care subsequently, a highly valued product will be obtainable. The high esteem in which the Portland cements of the Lehigh and some other districts are held, has only been made possible by long years of experimentation, the expenditure of vast sums of money and the possession of rock masses easily available for use at a reasonable cost.

While it is not always a safe guide in selecting a *Standard*, from which other commodities—rocks, iron ore, coal, etc.—are to be valued, one is generally rather safe in taking the opinions of the purchasers or users. The continual use of a certain ore or coal (and it is assumed that others are available at the same cost) would indicate that satisfactory results have been attained, otherwise a change would have been made.

It is pretty generally conceded that no better Cement is made than that produced along the Lehigh River in Lehigh and Northampton counties, and that as a cement, whose chemical analysis approaches or recedes from that of the Lehigh region, its value is determined; in other words, it is a good Standard from which others are to be judged by comparison.

The best results have been obtained when, upon analysis, the mixture ready for the kilns shows that it contains, say 76 per cent. of Calcium Carbonate and 20 per cent. of clayey material, the latter consisting of alumina, silica and oxide of iron. The Carbonate of Magnesia should never exceed 6 per cent.

The Cement rock proper is an argillaceous limestone, carrying from 60 per cent. to 80 per cent. carbonate of lime and from 15 per cent. to 30 per cent. of alumina, silica and oxide of iron. To bring the mixture up to the Standard, as given above, it is necessary, in some cases, to add to it some of the rock of the purer limestones found below; while in others some of the overlying shale must be added to reduce the percentage of calcium carbonate. It is interesting to study the variations in the character and chemical composition of this formation. Near the point of contact with the Hudson River shale, the next highest formation, the rocks are impure—the impurities (alumina, silica and iron oxide) almost equaling in amount the calcium carbonate. Below, the impurities rapidly decrease and the rocks be-

percentage (76 per cent.). At some of the quarries the reverse is necessary, *i. e.* a stone much less pure is added to reduce the percentage of Carbonate of Lime.

Thus it will be seen that with the exception of cases where the proper mixture is found in Nature, and since the Natural Cement rock, we have learned, varies greatly, it is necessary to have both the pure and impure rocks to secure dependable raw material for the manufacture of Portland Cement.

I want to impress upon you that, because of its variability, a Natural Cement rock alone is not to be depended upon and, even while it closely approximates the ideal mixture, it is far safer if rocks of higher or lower percentage of calcium carbonate than the Natural Cement rock itself are available, for increasing or reducing the calcium carbonate constituent.

It must not be supposed that the Trenton limestone or any other limestone, wherever found, will be adapted to the manufacture of Cement simply because they have been found so in certain localities. Each deposit must be measured, sampled and an analysis or analyses made to determine its adaptability to the purpose before deciding upon its purchase or the erection of a plant.

The following table* of analyses exhibits the composition of the materials from the Trenton limestone used in the Lehigh District.*

*Bulletin No. 245, U. S. Geological Survey.
*Bulletin No. 248, U. S. Geological Survey, page 289.

	Cement Rock.						Pure Limestone.		
Silica (SiO_2),	15.06	19. 4.	19.08	22. 22	18.80	9.02	19. 02	14.20	2.14
Alumina (Al_2O_3),	9.02	4. 4.	7.92	7.24	6.08	4.72	5.03	6.14	1.46
Iron oxide (Fe_2O_3),	1.27	1. 1.	07.07	08. 45	76.06	80.71	69. 73	74.30	1.90
Lime carbonate (CaCO_3),	70.10	60. 5	4.08	4.55	4.51	4.92	4.90	3.24	.70
Magnesium carbonate (MgCO_3),	3.80	4. 4.							95.19 2.08

In Western Pennsylvania several Portland Cement plants are using successfully material afforded by the Vanport limestone, while the Stewart Iron Company, of Sharon, Mercer county, is making a slag cement from the blast furnace slag and calcined limestone, the latter being derived from the Vanport limestone quarried at Wampum, Lawrence county, by the Crescent Portland Cement Company.

The Vanport (Ferriferous) limestone at the quarry of the above named company attains a thickness of 25 feet. It is divided into three (3) benches, the lowest being the purest, its Calcium Carbonate percentage being nearly 93 per cent. with a magnesia constituent of less than 1 per cent. The material of the benches is too high in Calcium Carbonate, and to bring this within the limits, the overlying shale is mixed with the limestone.

CEMENTS.

Cements are of two kinds, hydraulic and non-hydraulic. Under the head of hydraulic cements are classed Hydraulic limes, Natural Cement, Portland Cement, Slag Cement and Puzzolan Cement.

Hydraulic limes slake and set slowly, but alone they have but little, if any, strength. The limestones from which they are made contain from 15 per cent. to 20 per cent. silica and alumina.

Natural Cement is made from limestone high in impurities and burned at a low temperature. It does not slake in water, unless reduced to a powder. It hardens rapidly and will set under water, but lacks the uniformity and the strength of a well made Portland Cement.

Portland Cement. This is the most important cement and is made by burning, at a very high temperature, an artificial mixture of raw material, composed of lime, alumina, silica and iron oxide properly proportioned, to a clinker which, when reduced to a powder will set under water.

Slag Cement is produced by burning a mixture of limestone with blast furnace slag. When finely ground, this cement will likewise set under water.

Puzzolan Cement is produced by mixing powdered slaked lime with either volcanic ash or blast furnace slag. No burning is required.

The total production of Portland Cement in Pennsylvania, by counties, in 1908, is as follows:

	Barrels.
Northampton,	11,321,604
Lehigh,	5,920,317
Lawrence,	981,648
Mercer and York,	31,237
Total,	<u>18,254,806</u>

He estimates that the yearly supply of limestone and shale required for one kiln will amount to 20,000 tons, of which 15,000 tons are of limestone and 5,000 tons of shale. It will, therefore, be seen that at least 300,000 tons of limestone and 100,000 tons of shale will be required to supply a kiln for twenty years. Considering the quantity in dimension instead of weight, his figures show that the amount of limestone required will be 3,800,000 cubic feet, and the shale 1,600,000 cubic feet. Unless such a supply or a still greater one be available, the erection of a plant had better not be undertaken.

TABLE OF THE PRINCIPAL LIMESTONES OF PENNSYLVANIA COMPILED FROM VARIOUS REPORTS.

Names of Lime-stones.	Color.	Character.	Percentage of Calcium Carbonate.	Percentage of Carr-bonate of Magnesia.	Uses.	Remarks.
Upper Washington, ---	Blue gray to bluish black.	Hard, compact, ---	72.866	3.813	Fertilizer — Not cement.	Available for cement, if constant. No analyses.
Waynesburg, ---	Dark gray, ---	Compact, ---	a 37 to 69.0	a 14 to 80	Lime, Natural cement, ---	Some portions may be available for cement.
Great limestone, Uniontown, Lower Sewickley, Bedstone, ---	Buff, ---	Siliceous, ---	96 to 97	2 to 15	Fertilizer, ---	Rather a pure limestone.
Dark blue, ---	Dark blue, ---	Compact, ---	17.711	17.711	---	Variable—high in magnesia.
Pearl gray, ---	Pearl gray, ---	Hard, ---	1.7 to 2.9	---	---	Usually of no economic value.
Pittsburg, ---	Bluish gray, ---	Soft and brittle, ---	88.0 to 98.0	---	---	Variable—high in magnesia.
Elk Lick, ---	Bluish gray, ---	Compact and brittle, ---	55.6 to 90.8	2.7 to 14.2	Fertilizer, ---	Not of economic importance.
Ames or Orinoldal, ---	Bluish or greenish gray, ---	Fossiliferous, ---	g 84.0	g 2.13	---	Available for cement.
Upper Freeport, ---	Light gray to buff,	Brecciated, ---	88.0 to 98.0	1.40	Fertilizer, ---	Thin—variable.
Lower Freeport, ---	Light gray, ---	Fine grained, ---	e 82.3 to 98.9	e 1.8 to 8.0	Fertilizer, ---	Too variable for cement.
Johnstown Cement, ---	Bluish gray, ---	Hard, ---	d 84.301	d 21.650	---	Generally pure limestone.
Vander Ferriferous, ---	Grayish, ---	Fine grained, c	c 88.2 to 98.8	0.988 to 1.740	Lime and cement, ---	Not of economic value.
Upper and Lower Mercer, I Mountain, ---	Grayish, ---	Coarse grained, ---	h 40.0 to 64.2	h 1.371	---	---
Loyalhanna, ---	Bluish to white, ---	Hard and soft vari-ble, ---	g 60.0 to 92.0	g 2.0 to 16	Cement—fertilizer, ---	Variable—fertilizer purposes.
Benezette, ---	Upper member blue, Bluish gray, b	Very brittle, ---	76.143	---	Ballast, ---	Not adapted for cement.
Lower Helderberg, ---	Gray, bluish-gray, ---	Compact, ---	73.0 to 96	1.38 to 4.31	Fertilizer, ---	Sometimes good for cement.
Trenton, ---	Bluish gray, ---	Compact, ---	60.0 to 98	.86 to 8.86	Lime and cement, ---	Rather pure generally.

*No analyses available.

a Benwood limestone in Washington county.

b Middle Bench, Elk county.

c At Johnstown.

d In Jefferson and Indiana counties.

e Not of economic importance.

f In West Virginia, near Tinton, Forest county.

Note.—These results are not averages for the whole State, for in some cases, the figures and descriptions are based on a single locality.

ORCHARDING IN PENNSYLVANIA.

By PROF. R. L. WATTS, *State College.*

Men who have a knowledge of the markets of the world claim that the markets of this State are unsurpassed. Our two largest cities, Philadelphia and Pittsburg, consume enormous amounts of all lines of produce, while interior towns and cities demand an additional supply which is not realized by our land owners. The great lumber, mining and iron industries of the State have absorbed the interest of all classes, the farmer included, so that we have not appreciated the splendid markets in every section. While we have been busy looking after the wealth of natural resources, other states have been developing orchards to feed our people. Immense shipments of apples are sent from New York and the West to this State. Peaches are sent to our markets from Maryland, New Jersey, Delaware and Ohio. Grapes from New York; pears, plums and cherries from several states. But a change is taking place. Our people are beginning to appreciate the value of our home markets and to realize that soil and climatic conditions in this State are admirably adapted to a full line of fruits. Commercial orchards here and there are paying their owners good returns. Increased zeal is noticeable in many of the counties. County Horticultural Societies are being formed throughout the State and fruit culture is the most popular subject for discussion at many Grange meetings and Farmers' Institutes. Hundreds of students are going to State College to study Horticulture and hundreds of other young men are taking correspondence courses in fruit culture. A great educational campaign is on and it is a prophecy of much better days in orcharding in Pennsylvania.

The ultimate success of orcharding in this State depends primarily upon the quality of the fruit produced. Our markets are being educated and consumers are demanding quality more than ever before. The Ben Davis era is rapidly passing. This variety has made money for thousands of orchardists, but it will be in little demand in the future. People are beginning to ask for Spy, Stayman Winesap, Grimes Golden, Jonathan, Smokehouse, Spitzenburg, Newton Pippin and other varieties of strictly high grade. Apples of such varieties sharpen the appetite for more, thus increasing consumption. With our export trade it is not likely that we will ever have too many apples of the highest grade.

PLANTING AND CARE OF THE YOUNG ORCHARD.

Some soils and locations are better than others for the growing of apples, but good apples may be grown on any well drained and properly treated soil. It should be prepared for trees with just as much care as for potatoes. If sod land, plow in the Spring and plant corn. If desired, the trees may be planted with the corn, being careful that no corn stands closer than four feet from the trees. The trees should be properly fertilized and cultivated to secure a satisfactory growth.

Plant only varieties of high quality, unless varieties of fair quality are known to be especially successful in your locality. One year trees are preferred to older trees, although many successful growers are planting two year trees. The one year tree is usually difficult to secure because the nurserymen do not want to sell them. But they are worth more money and the grower should be willing to pay the additional cost. They give him full control of top formation.

Low heading has all the arguments in its favor. If the one year whip is cut off 32 or 34 inches from the ground and the bud for the first limb 10 or 12 inches below this, an ideal top can be formed. The three to five limbs should be distributed over this distance of 10 to 12 inches.

If the land is rough, stony or hilly, mulching can be followed to advantage. There is no doubt in the minds of experienced orchardists that the sod-mulch treatment when properly carried out is fully as satisfactory as clean tillage.

Companion cropping or inter-cropping in orchards is becoming more and more popular, because it enables the grower to meet the operating expenses of the orchard until the trees attain a bearing age. It is possible to do even more than this. Certain orchardists in New Jersey have purchased farms, planted them at once with trees, and by companion cropping have not only paid for the operating expenses, but have paid for the farms from the profits of the first few years' crops grown between the trees.

Companion crops which may be started early in the Spring and harvested in time to start cover crops are best adapted to this purpose. If the legumes can be used, they, of course, possess an additional advantage in being soil improvers as well as money makers. Peas and beans are grown in some orchards to good advantage. The crops are sold in the green state and the vines cultivated into the soil, thus supplying vegetable matter analyzing high in nitrogen. Other vegetables which are well adapted to companion cropping in orchards are early potatoes, dwarf varieties of early sweet corn, early tomatoes and the summer vegetables, such as lettuce and root crops. Early potatoes are especially suitable for this purpose because they may be grown in a great variety of soils and can be sold in large quantities at prices which generally leave a good profit for the grower. One of the best orchards in Pennsylvania has been developed with potatoes as a companion crop. Several years ago H. C. Snavely, of Lebanon county, started a peach orchard and grew potatoes between the trees until the trees took full possession of the ground. The venture was a success, both from the standpoint of the potatoes and the trees.

the colder parts of the State, where the soils are heavier and more tenacious in character. For southeastern Pennsylvania it is decidedly the best cover crop. In the northwestern and colder parts of the State mammoth clover should be more generally used. It makes a more vigorous growth than red clover, thus adding more vegetable matter to the soil. Rye and vetch together should be more generally used in our orchards. This combination was used on the farms of the late Hon. R. F. Schwarz with the very best results. When orchard soils are especially lacking in vegetable matter, cow peas, soy beans and oats can often be used to advantage. These crops should be started in ample time to make a heavy growth before frost. In soils which are very much lacking in vegetable matter it is important to start cover crops earlier than is usually practiced. As the soil increases in humus and fertility it is possible to sow earlier and thus get more vegetable matter for manurial purposes.

Orchard experiments by Professor J. P. Stewart, of the Pennsylvania State College, indicate that nitrogen is the most valuable fertilizer that can be used in the young and old orchards of this State. It may be furnished by the application of nitrate of soda, barnyard manure or any other material that carries the right amount of nitrogen. It is also important to use the mineral elements in proper supply. Most of our growers have maintained that the all important thing in fertilizing is to make liberal applications of mineral elements without paying much attention to nitrogen. The better practice in all probability for most orchards would be to use complete fertilizers carrying a liberal amount of nitrogen as well as the mineral elements.

Fruit growers in every section realize as never before that spraying is one of the essentials in successful orcharding. The time is not far distant when every man in the State who attempts to grow fruit at all for market will spray more or less thoroughly. The results in spraying do not depend so much upon what is used but upon how the work is done. Either lime-sulphur solution or a good miscible oil will kill San José scales if the sprays have been properly prepared and the applications thorough. The lack of thoroughness has been the cause of failures in the great majority of cases. One of the greatest insect foes of our orchards is the codling moth, and nearly all of our fruit growers are using arsenate of lead to control this pest. This poison can be used in connection with Bordeaux mixture or used alone. Lime-sulphur as a summer spray is attracting much attention and indications are that it will take the place of Bordeaux mixture in the control of apple scab, brown rot of the peach and other fungous troubles.

ORCHARD RENOVATION.

There is renewed interest in orchard renovation. Most old orchards in this State would return their owners handsome profits if the trees and soils were given the proper treatment. The best example we have of the value of renovation is the old orchard on the fruit farm of Tyson Brothers in Adams county. An old family orchard of fifty-four trees, occupying one and one-eighth acres was cut back very severely in the fall of 1903. The trees were very much lacking in vigor, the foliage poor and the fruit half size in dry

seasons, with at least seventy-five per cent. of the specimens defective. The orchard produced scarcely enough good fruit to supply the family. The first thing accomplished was to cut out the tall central limbs clear back to the main trunk. Two cuts were often made to avoid splitting. The object was to induce a growth of new wood from the body of the trees to constitute the main part of the head. The orchard had not been plowed for ten years until 1904, when it was manured and plowed. The land was harrowed repeatedly during the summer. With this kind of treatment a great many suckers grew and it became necessary to remove most of them. A fair crop of apples was produced in 1905. 1906 was the off-year in Adams county and the crop was light. In 1907 the gross receipts from this orchard amounted to \$884, and Tyson Brothers estimate that \$600 of this amount was net. The crop in 1908, which was again the off-year, more than paid expenses, and although all the apples of 1909 have not been sold, these fruit growers estimate that the receipts will run at least \$950. This old orchard was about as much run down as any orchard that can be found in the State. The trees were 37 years old when cut back. One old orchardist in Adams county informed me that 35 years is the limit of profits from the York Imperial, but the experience of Tyson Brothers indicates very clearly that it is possible to renew such old orchards and secure handsome profits. The pruning in old orchards consists, first, in the removal of all dead and dying wood and in cutting back tall and central leaders to the main trunk; second, in cutting back leading limbs six feet or more, being careful to cut to lateral branches which are located where they will fill open spaces, thus securing a well formed, rounded head; third, the thinning of suckers which form in large numbers. The most feasible plan, perhaps, is to leave more suckers than are desirable years later. These suckers will soon form fruit spurs and thus increase the yield, and it is a simple matter to thin them later in the life of the orchard when the top becomes too dense. After pruning, which may be done any time when the trees are dormant, a thorough application of lime-sulphur should be made to destroy scale insects and to smooth the bark of the trees. A few applications of lime and sulphur will give the trees a much healthier appearance. Most old trees have been checked in growth and special soil and fertilizer treatment is necessary to start new growth. There is nothing better, or perhaps quite so good, in the long run as barnyard manure. A covering of several inches should be made under each tree and then plowed or disked into the soil. Deep plowing should be avoided. The aim should be to secure as deep mulch as possible and not injure the roots. Such tillage should be given early in the spring before the small and tender roots have formed. If for any reason it is not practical to cultivate the soil, the same results can be secured by heavy mulching, using any kind of straw. Strawy manure will serve the purpose better in old orchards in which the growth has been stunted. When clean tillage is practiced, the harrows or cultivators should not be used after mid-summer. It is important to start cover crops early so as to secure a maximum growth during the fall. The greatest need of our old orchards is vegetable matter and a course of green manuring should be adopted, which will give the maximum amount of material to plow down in the spring.

The greatest problem of the Pennsylvania fruit grower is that of marketing. The packer of the future will be forced to exercise greater care and skill in preparing his fruit for market as well as in making disposition of the fruit. The barrel package will probably always be standard, but it is interesting to note the increased popularity of the bushel box. This is the standard package of the West, and it is being sent to our large markets in the East in such large quantities that eastern growers are taking up the question and making arrangements to pack part of their crop in this package the coming season. Some Pennsylvania growers used the box pack the past year. For example, N. J. Lewis & Brother, of Luzerne county, are packing in boxes this winter such varieties as Baldwin, Spy, Rhode Island Greening, Rome Beauty, Smokehouse, Seek-no-further and Newton Pippin. These apples are wrapped in paper and packed in bushel boxes. The number of apples in each box is 45, 88, 96, or 112, and the boxes containing 96 and 112 are most in demand. The price ranges from two to three dollars per box, and they are sold direct to consumers. The apples have been shipped to towns covering most of the eastern part of the United States, and are sold by what is known as the endless chain system, i. e., a few boxes were sold last fall to city consumers, who were willing to pay the price for first-class apples, and a letter accompanied each shipment with the request that the purchaser tell his neighbor about the fine apples which he secured from the Luzerne county growers. This letter has accompanied each box during the winter, with the result that the entire crop will soon be sold at the good prices named. The bushel box is a convenient package and appeals to the consumer. It is possible that small boxes holding a half bushel or a peck would be popular with people who do not care to buy as much as a bushel.

A great deal has been said and written lately about the profits of apple growing in the famous apple sections of the Northwest. No one doubts the adaptability of this region for the growing of apples, and while we have dreams and visions of the apple sections in the West, we should not lose sight of the fact that just as great opportunities for fruit culture are afforded right here in Pennsylvania. The exhibits made recently at State College and Tunkhannock of Pennsylvania apples in competition with Western fruits show that our State is growing apples of just as high color and of better quality than the Northwest. But how about the profits? Can figures be presented which show that the business is as profitable in Pennsylvania? Yes, there are many in this State whose profits are probably equal if not greater than in the Northwest. Not long since, Mr. C. J. Tyson, Secretary of the State Horticultural Association, delivered a lecture at State College in which he compared the profits of apple culture in the West with the East. He went to the bottom of this whole question and the figures presented were authentic. He said that when Spitzenburg apples were selling for three dollars per box in New York at wholesale and Newton Pippins at two dollars and fifty cents, that the Adams county grower could count on two dollars and fifty cents for York Imperial. The cost of preparing for market in the Northwest is generally conceded to be about one dollar per box. The freight to New York is fifty cents and the commission is fifteen cents. This makes a total of one dollar and sixty-five cents, or a profit of one dollar and thirty-five cents per box. This, however,

does not take into account the interest on the land. Such land is usually valued at one thousand dollars per acre, and the interest on this amount would be sixty dollars. In the regions referred to the average yield is about three hundred boxes per acre. This would make an average of three hundred and seventy-five dollars per acre, but with the interest deducted, it is three hundred and fifteen dollars. Assuming that it costs as much to grow high grade fruit in Pennsylvania as in the Northwest, which is probably not true, we have one dollar for cost of production and preparation for market, fifteen cents commission charges and ten cents for freight to New York. Total expenses are one dollar and twenty-five cents per box. If the apples were sold at two dollars and fifty cents per box, there would be a profit of one dollar and twenty-five cents, and three hundred boxes per acre would give us a profit of three hundred and seventy-five dollars, deducting five dollars for interest (land valued at one hundred dollars per acre), and there is a net profit of three hundred and seventy dollars per acre or fifty-five dollars above the average results of the famous orchards of the Northwest. Orcharding in this State looks like a good business proposition, but our people must bear in mind that large profits cannot be secured without being just as thorough as the fruit growers of the Northwest. With the keen competition of the Northwest and the general awakening in this State, it is useless for anyone to consider planting orchards unless they intend to till, feed, prune, thin, spray and do everything according to the most approved and up-to-date methods.

REPORT OF THE APIARIST.

By H. C. KLINGER, Chairman.

The year just passed has been full of interest to the bee-keeping world. This may, perhaps, always be said, for there is no avocation connected with tilling of the soil or any other occupation or profession that affords a keener pleasure or deeper interest than that of keeping bees. And yet there may be some of us who have bees about us and derive neither pleasure nor profit from them. To such they appear as they did to the one who wrote:

“A little bee
Sat on a wall;
And it did buzz,
And that was all.”

PRODUCT OF THE APIARY.

Perhaps one of the things of most importance is the condition of the year's product of the apiary. Reports from all over the State and, in fact, the whole United States, are that the crop has been below the average in quantity and very much below in quality. Colonies

came from their winter quarters in fair condition and with no great percentage of loss. Brood rearing began in time and prospects showed fair for a good crop of honey. The white clover season had hardly set in when the drought began and continued throughout the summer.

The crop of honey of a good quality was small. The season was remarkable for the abundance of honey dew. Even when blossoms were abundant the bees would forsake them and betake themselves to the woods and gather the "Heavenly dew," as some prefer to call it, in preference to the nectar in the flowers. Owing to the continued drought, nearly all the honey was mixed with the "dew," ranging from 10 to 90 per cent. of the latter. This product is usually of a darker color and poorer flavor than pure honey, differing, however, with the locality. Some of it is clear and of a fair flavor, whilst most of it is of poor quality and of a muddy, greenish color.

Honey dew is not an uncommon phenomenon. It occurs once every few years, but only once in about twenty-five years in such large quantities. It is not honey, and according to the food laws can not be sold as such. Honey is the secretion of nectar from the blossoms of plants. Honey dew is either a secretion from the leaves of trees and plants or a secretion from the glands of plant lice, known as aphides, and sometimes from both. It is always inferior to honey and should not be placed on the market and sold as such, for its sale will injure the market for good honey.

It is not even a good food on which to winter bees. It contains such a large percentage of waste matter that when bees are confined for weeks and sometimes months without a flight it is likely to cause dysentery and loss of the colony. There is great fear entertained by apiarists that there will be a large loss this spring because the winter stores largely consist of this "dew." It is best to extract it in early fall and feed sugar syrup for winter stores. The "dew" may be fed in the spring to stimulate brood-rearing or later on for comb-building, for which purpose it is as good as any other honey or syrup.

BEE DISEASES.

The other subject which is demanding the attention of every bee-keeper is that of bee diseases. Very little notice is frequently taken when a colony dies as to the cause, even if the disease is deadly contagious and contaminates every colony "on the place."

There are two diseases which are prevalent all over the United States, and within the last few years have been spreading considerably in this State, that of European and American foul-brood. These diseases are caused by germs which attack the larvae in the cells,

keeping work of the Bureau. During the last year thousands of circulars were sent to all parts of the United States asking for samples of the diseases. Over 600 samples were sent in and bacteriologically examined, bringing the number of cases now up to over 1,000. Dr. Phillips prepared a map showing the infected districts of the United States and, coming to our State during our last Annual Bee-Keepers' Convention, he showed a map of Pennsylvania with the counties where the diseases prevail marked in colors. One or the other of the diseases is found in about one out of every four counties of the State, and sometimes both prevail. Fearful to say, the result of this investigation does not yet determine that the counties not marked are not infected now, nor long to be immune, since the diseased districts are all around those not marked and which may at this time be free from it.

The following states and territories now have laws for inspection of apiaries: California, Colorado, Connecticut, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, Nevada, New Mexico, New York, Ohio, Oregon, South Dakota, Tennessee, Utah, Washington and Wisconsin. Some of the islands and European countries have similar laws.

A number of other states, among which is our own, have made efforts to have laws passed for the inspection of apiaries, but have failed. The spread of these diseases, if not controlled, is bound to "put out of business" the bee-keepers of this State. It will require a vigorous campaign of education coupled with a law providing for a State Inspector of Apiaries, whose duties will be to instruct and assist bee-keepers in treating the diseases. Pennsylvania has almost unlimited resources in her bee-keeping interests, but even to maintain her present position among the States it requires organized and united efforts and eternal vigilance.

REPORT OF GEOLOGIST. No. 1.

By DR. ISAAC A. HARVEY, Lock Haven, Pa.

With an experience of twenty-eight years in practical geology, I am prone to magnify my profession, in this sense at least, that its influence upon the spirit of its votaries, having an intelligent conception of its province and uses, is inspiring and uplifting. Indulge me in the expression of this much egotism: that, as a graduate, practically, in the ministry and law, with a very wide reading in medicine, as a physician's son, I am free to say that the attainment of a practical and efficient knowledge of geology is quite as difficult and exacting as that of the other professions named; and while the gospel minister has some security in his calling from mountebank preachers and tyros and cranks; the doctor is protected by adequate laws from the aggressions and impostures of quacks, empirists and charlatans, and the lawyer has his safeguard in the legal restraints upon the pretender and self-styled and self-constituted attorney, yet it is true

that competent and well accredited geologists and mineralogists (as well as engineers) have no protection from the imposition of fakirs, who, with their hammers and pick and shovel, offend the honesty and dignity of the name they assume as geologists or mineralogists and dupe, deceive and mislead the farmer and others, who possess only a vague and obscure notion of the geological idea; and these same fakirs, wild, perverted and erratic, bleareyed and blatant, oftentimes, too, as truthless as they are toothless, practice their game of fraud and deception upon the credulous land owner and persuade him that his property contains, perchance, coal or clay, copper or iron, or even gold or silver, in fabulous values, and which will be disclosed if only the said owner will fee the human hyena for scenting out or opening up to the farmer or other land owner the possibilities of his hitherto unsuspected or unknown riches. Thus, the farmer, more than any one else, becomes the victim and is swindled, and his money and labor are expended in a vain search for minerals in rocks that cannot possibly contain them; and in outlandish places he digs, say for coal or clay or other deposits, where he might as wisely dig for poke-root or potatoes.

Last year a farmer came to me and, in his credulous manner, explained the theory propounded to him and his brother, that the precious metals, as well as coal, were to be revealed on their farms upon which the exposures, as I know them, were the black shale of the Hudson River and Utica formation, and the Lower Silurian limestone; and that these facts were revealed to them by a certain geologist that came that way. I admonished him to be guarded, and told him to send the geologist to me and I would tie him up in half an hour, while, in reality, the sheriff ought to handcuff him; but the stranger succeeded in filching out of those poor men \$300 or \$400 without showing anything of value. And so it goes all over the State. The Pennsylvania Society of Engineers, of which I am a member, is considering a memorial to the Assembly towards an enactment to protect the people from such thieves and impostors by requiring some credential or certificate as evidence of competency from every engineer, geologist or mineralogist, so-called, and thus avert this oft repeated deception. I know of farmers that have been duped and lost their farms by the expenses incurred in developing the carbonaceous shale and slate of the Number III formation, known as the Hudson River shale and slate, under the impression that they would eventually find anthracite coal. Such people certainly deserve some protection or safeguard from this criminal class, for such they are.

Clay is any rocky substance that, being ground or pulverized fine and mixed with water may be molded into any shape. The clays of Pennsylvania are of wide and diversified value and interest in their various forms and deposits. As classified by me, upon the basis of my own experience, they are as follows:

Hard or flint clay, adapted to refractory brick for furnaces and kindred uses; semi-hard clays, of rocky structure, but less compact and firm than the hard or flint clays; soft clay, a rather indefinite term as usually employed, since it thus comprises all the clays that have not the flinty hardness and absolutely rocky structure of quartz or feldspar, from the latter of which much clay is derived by weathering or disintegration. My term of soft clay includes such as have a semi-firm or tough structure, while not as firm as the semi-hard clay.

and yet more compact than the plastic clay which constitutes, in my view, all such clays as, without previous manipulation or grinding, may readily be molded into the several shapes required, being already moist, without mixing with water. It is one thing to be a clay man, as I replied to a certain State Senator who applied the term to me; but quite another thing to be a putty man. The several clay deposits may only disclose their actual utility by analyses and experiment, and, doubtless, many of the local deposits on your farms, of a plastic or semi-hard nature, would be found of some value if you had them properly tested; as much of the imported clay could be replaced by the output of such domestic deposits, if the same were investigated.

I remark here that our hard or flint clay, so much esteemed for furnace brick, is found only in local deposits; being, for the most part, beneath the A or Brookville Coal seam, at intervals varying from 0 to 40 or 50 feet, and in this era in brick making, no other deposit can replace it or afford the same durable product of fire brick, at least by the methods of manufacture practiced here and now in vogue, yet some of the floor clays of the other coal seams, in very limited area or extent, have afforded satisfactory results. I have noticed the comparative qualities of our clays and those now in use in England, Scotland and on the continent, and it is noteworthy that our refractory brick clays surpass foreign clays in their per cent. of alumina, which is the desirable and important element of the clays mostly used; the alumina, of course, being the cementing or bonding quality of the fire brick. Likewise, the European clays are higher in silica or sand. Thus we claim and use a better grade of clay on the average, because, upon our basis, the aluminous clays are superior. This difference is an excess of five to eight per cent. of alumina in our clay, as used for furnace brick, and the same excess of silica in the foreign clay. Now we have immense deposits of clay that analyze the same as European clay; that is, lower in alumina and higher in silica than the clays we are now using; and while some of these are used incidentally and applied to various purposes in furnaces and rolling mills, yet for the most part they are discarded, as, for the time at least, without value; just like our first lumber operations cast aside timber that latterly has proved valuable and the certain coal beds and areas, that formerly were left alone, are now being mined and utilized. We will soon have to come down to the same basis as other nations in the application and uses of our clays, and when the flint clay, representing the one deposit beneath the coal seam, shall be depleted, we shall be compelled to experiment until we can use the clays in wide acreage that are now recognized in the fire brick plants; but are quite as good as many European clays that are applied to the most exacting demands of steel and iron making.

The cement industry is a marvel of growth, and no possible or conjectural idea can be suggested as to its progress in the future. Many a time the farmer has complained to me in years agone that he had a species of limestone on his farm, perchance, dark gray or bluish gray, of block or shaly structure, or even conchoidal in its fracture, and he tried to make quicklime out of it. It burned into grayish blocks and dust and he scattered it over his field, and, much to his disgust, it formed into hard lumps like cement and would not dissolve; so that he was at a loss to know why his limestone could not be used for fer-

tilizing purposes. By analysis it shows a low per cent., comparatively, of lime, with an admixture of five or ten per cent. of alumina and fifteen or thirty per cent. of silica; so that his limestone is of a mongrel or bastard nature, so-called a few years ago, but now dignified by the name of a natural cement rock or limestone and, perhaps, requiring only an addition of twenty or forty per cent. of pure limestone and some slight increase in alumina or silica to make a typical grade of Portland cement; as the native cement rocks do not produce the most valuable commercial cement, as, for instance, in the Lehigh Valley, an additional ingredient of higher grade limestone is supplied to the native cement rock to yield the admirable results thus realized in the shape of first-class Portland cement.

The range of composition in Portland cement mixture, which I quote from a West Virginia report, is about as follows:

	Min. Per Cent.	Max. Per Cent.
Silicia, -----	19	26
Alumina, -----	4	10
Iron, -----	2	5
Lime, -----	58	67
Magnesia, -----	0	5
Sulphuric acid, -----	0	2.5
Alkalis, -----	0	2.8

A certain limestone near Lock Haven, being assigned to the Marcellus formation, shows this analysis:

Silicia, -----	22.64
Alumina, -----	6.72
Iron oxide, -----	2.93
Lime, -----	36.64
Magnesia, -----	2.02
Loss by red heat, -----	29.42

This shows a quality of native cement rock which would produce Portland cement by the addition of twenty-five to thirty per cent. of high grade limestone. I note also that a German product is made upon this formula: One part each of silica, alumina and iron and one and seven-tenths parts of lime, which seems to be a wide digression from the formula usually applied in this country.

So, from the highest limestone, of a few feet in thickness, in the Upper Barren Measures, in Greene and Washington counties, down to our Lower Silurian Limestones, the Trenton, Chazy and Calciferous, we have various possibilities of cement, either in the local changes that these limestones undergo, from place to place, or in the various interleaved layers that are associated with these limestones and which we know as bastard or shaly limestone, but latterly termed cement rock.

The list is as follows:

Limestones in the Upper Barren Measures.

Limestones in the Upper Productive Coal Measures.

Limestones in the Lower Barren Measures.

Limestones in the Lower Productive Coal Measures, comprising the two Freeport Limestones, the Johnstown Cement Limestone and the Ferriferous Limestone.

The Mountain Limestone, at the base of the Pocono Sandstone.

The Helderberg Limestone.

Limestone in the Marcellus Formation.

The Clinton Limestone.

The Lower Silurian Limestones, the Trenton, Chazy and Calciferous.

From many, or all of these, may be derived, either locally or generally, some good native cement rock. So you will be wise if you keep advised of the progress and demands of the Cement Industry and notice your limestone formations. This cement business is hardly more than in its inception or initiative, and the vast structural works that have been completed, with others in progress, and wonderful bridges, buildings and other improvements in contemplation upon the concrete idea, which, of course, requires cement. Be on the alert in these things, as you should be in many other things, and don't be deceived, but learn expediency and wisdom by past experience. What you have is your own, and your indolence or indifference may lose much of value by the device of the fakir, crank, the impostor or the unscrupulous speculator.

I touch briefly on "Tenantry," which, even admitting its wisdom and entire propriety under certain favorable conditions, yet in its broadest aspect, in city, town and country, it is a nation's sorrow and tends much toward a nation's undoing. The necessity for tenantry, broadly speaking, arises more from the erratic, commercial idea and unjust practices along general business lines than from any other cause. The old-time farmer was far happier in his ownership of the farm home and, with his neighbors of the same social, financial and religious spirit and status; but the slipping away of the farm and its replacement by an enforced tenantry is a menace that savors of semi-slavery or serfdom, and applying as well to the city as to country, having indeed a semblance of the old feudal system. I do not reflect upon the well-to-do farmer, who feels compelled to rent his farm or employ a tenant; but the prevalent usage and application of this idea has shown a decline in self-respect and a depletion or enervation of those positive, patriotic and moral energies that formerly characterized the farmer and molded his life. In a general sense tenantry nowadays is the genesis of national discontent, unrest, distrust and doubt. With these results are, also, the deplorable decline and changes in social life; sad enough, and that betoken only the dull, hard, monotonous routine that is prescribed for many, many of these people that cannot own a home either in city or country; and from this spirit arises bitterness and resentment and the sense of ownership will steal into the mind and ideas of the tenant and, realizing his comparative helplessness, such a conviction or notion is most readily distorted into a species of socialism, communism or, indeed, anarchism. Tenantry as a recourse or expedient should be the exception; the farmer on his own farm the rule.

There are corners in nearly everything and ultimately in corn, cotton, coal, coke, cement; corners in everything except Christianity; and trusts in everything but a wise and reasonable trust in the Gospel and Jehovah. Is this a re-enactment of the history of ancient Rome

with its aristocracy and its follies? Of its comedy and then tragedy? While you are striving in the direction of good, worshipping, I trust, with righteousness and blessing, devotion and praise towards the Holy City, do not forget the duty devolving upon you to sustain alike the integrity of the Gospel and the National Union. "For the perpetuity of the American Union," said Governor Shunk, "depends upon the virtue and intelligence of the people." "Ye are the salt of the earth," and whatever may be your faults, follies or frailties, it is to be devoutly wished that your perception of right and wrong may never be so far perverted, your discernment of good and evil and justice, so far distorted, your natural kindness of heart, your benevolence and exalted patriotism so far blunted or your manhood so far undone that it will permit you to apply those iniquitous devices that you have so often seen used and employed by others to effect their ends in exigencies and demands less stern, less relentless and less exacting than have been some of your own in this world. You exert a powerful influence in civic affairs and are still quite potent when your energies are directly applied; for eliminate the farmer from the great national system, remove him as an influence with the moral force that he commands, and, with due respect to the many noble people of other classes, there will not remain enough of moral stamina and honest patriotism and love of country to sustain our nation through its possible ordeals or against the gigantic evils and corruption that menace the nation's life. You do not abuse your trust, but you resist the abuses. You do not impose false values, but you give true and actual values. You do not produce schemers and have no school for graft or commercialism, rapacious and inhuman. The error and iniquity, gross and malevolent, may be perpetuated by others away from the farm and the rural districts; the redemption, if there be any, may be secured by the moral spirit and energy of the farmer. I believe in the higher patriotism and the higher pantheism, but I do not believe in the higher criticism, derived from the devotees of a vague, wavering, uncertain and obstructed science; science, in this sense, falsely so-called, within its narrow limitations and borders, producing everything in theory, even a new religion; but devoid of broad, active, vivid humanity and as a rule destitute of versatile scholarship.

I believe that the ideal Republic and the exemplary Commonwealth can only be secured, realized and enjoyed under the guidance and the fostering potency and influence of the ideal religion, namely, the Gospel of Jesus Christ. There is something not entirely bright and promising in our dominance as a financial and business power in the broad world's contemplation; for this lurid commercial splendor of ours, gleaming away across the waters, flushing and flashing the Western horizon, to inspire the wonder and amazement of the great nations, and achieved, measurably, in wrong and injustice, may be but the glowing forecast of a great nation's calamity, the brilliant and glittering token of a great nation's ultimate dissolution; the gilded index of a far-reaching ruin; for, as I said in a prior address, a nation that accepts not the logic of law and love will get the logic of lightning. When we study history and revert to the past century, the one noble figure supreme and singular in its grandeur and glory is Abraham Lincoln, big-brained, big-handed, big-hearted and with a great big honesty of purpose; the first champion of rights of that

century, one of God's own; for God has his own and we know them, and whose example and admonition should be as potent to-day as in the sixties.

What afflatus or impact from Heaven or from its intelligence was vouchsafed to him as a sustaining, indeed, a sanctifying influence through the trying ordeal and relentless spirit of the great war; and did he hear the ominous voice of Jehovah as of old, "Let my people go." The spectre of slavery hovering over the flag, is it so now? With its stain and stigma of dishonor and unreason and injustice upon its folds was to Lincoln a certain harbinger of a nation's destruction or everlasting severance; and the menace that came from Heaven in response to the prayers of suffering millions, not only in bodily bondage, but in moral and political bondage, an admonition of punishment for a nation's broken compact with the Almighty, "Let my people go." Was some edict or assurance from Deity sent to Lincoln's heavy heart "My grace is sufficient for thee." When the sky was overcast with sullen, somber, leaden clouds, weaving, waving, wreathing, rolling and folding, as though in futile conflict; the cumulus, cirrus, stratus and nimbus and with scarcely a gleam or trace of light, was an assurance of hope, a promise of beauty beyond, given to him and to his storm-tossed soul, was it granted to discern through these gloomy clouds, parting, as by the fiat of Jehovah, to behold, I say, the Light of the World, radiant with the spirit of eternal mercy, love and truth, the supernal glory of the Son of God.

Did he not then and there for his country then and forever enter into a new compact with the Creator, to do His will. The years that approach us are full of tense and earnest meaning for us as a nation, and as Ruskin has said, "The evils with which we have to contend are increasing like the letting out of water." Yet there is a certain, if, indeed, somewhat dormant and latent patriotism, a vivid love of country and reserve, moral force and energy abiding in the minds and spirits of the American people, and intensely so, in the rural districts, that are an absolute assurance of the safety and permanence of our government and our institutions; but these energies for good must be exerted towards the suppression of great national evils and the firm establishment of benevolence, replacing or abrogating, every aspect of false and fabulous business; and with the prevalence of this idea, thought and motive everywhere abounding in the hearts of the people and exercised rightly, the world of mankind may view across the ocean the light and radiance of a new national purpose in the Gospel; our illogical attitude of plausible defense for our vulnerable faults and moral inconsistencies whereby we have many years incurred the just censure of other nations may be resolved into a God given determination to lead all the nations to a higher thought than rabid commercialism and Godless materialism; and ere many years pass the peoples across the waters may behold a new harbinger of a world's redemption and the glory of Mount Zion rising in the West.

REPORT OF THE GEOLOGIST. No. 2.

By W. H. STOUT, Pinngrove, Pa.

Until within comparatively recent time a huge octopus held in its grasp the minds and bodies of the human race. The tentacles of this devil-fish were numerous and may be designated as ignorance, tradition, superstition, fraud, ostracism, personal punishment, damnation. Since Copernicus, Galileo, LaConte, Spencer, Proctor, Hugh Miller, Lyell, Tyndall, Liebig, Newton, Harvey, Huxley, Darwin and their disciples have loosened the hold of the octopus one by one, the mind of man can feel free to give expression to honest conviction, free thought, free speech and science freed from bondage.

Geology especially was considered a dangerous heresy, but through modern teaching in educational institutions it has gradually gained a firmer footing, but even yet has not become as popular as it deserves, and by some persons looked upon with suspicion. As related to agriculture, geology is of first importance, but the time of fifteen minutes allotted to each speaker permits reference only to a few thoughts on this important subject somewhat epigrammatically.

A few things observed and gleaned from publications: That this earth has passed through many changes; that oceans and continents have been alternately changed; that continents are being leveled and sea levels changing; that upheavals and depressions have been in operation for time indefinite; that the same conditions prevail now as evidenced in earthquakes and volcanic eruptions; that the earth will eventually become uninhabitable; that the elements of fertility are largely derived from organic plant and animal life in seas and on land.

During the ages past, from the tiniest lichen spores to the successive and higher organized plants, forests, insects and animals lived and perished, leaving their remains to the disintegrated rock particles, forming soil from which all life obtains sustenance. How many generations of people lived during prehistoric periods may never be known; relics of the stone age alone affording any evidence of former races. Due to climatic changes there were alternate tropical, frigid and temperate conditions around us. The fossils found in coal and plant remains in the Arctic Circle are evidence that the climate has varied at different times, and the accumulation of later deposits upon the coal, of conglomerate, sandstone, limestone and shale thousands of feet in thickness is ample evidence of a succession of periods, during which seas and rivers prevailed over the earth.

The oceans relentlessly beating upon the shores, demolishing the granite and other rocks, forming gravel, sand and mud, to which is added the deposit of inland streams, afford in a measure a conception of what may have occurred during past periods when the hills and valleys now devoted to industry were in a formative stage. The streams and rivers are all charged with chemical elements constantly

removing the accumulated soil and, together with what is removed with crops, there is a steady drain on the stores of fertility so manifest on all sides that history may repeat itself and eventually a condition similar to that now found along the Euphrates, the Jordan and the Nile, where anciently fabulous populations maintained themselves on lands now unproductive, reduced to dearth and waste, largely given over to nomads and shiftless people; because the most useful of all resources of national importance were consumed in maintaining vast armies and an aristocracy that absorbed and devoured all the wealth yielded from the soil, until it can no longer claim the distinction once enjoyed of being the granary of the world, but a country exemplifying the beginning of an end when similar methods are pursued. The wealth of Croesus and Solomon did not save their countries from disintegration and ruin, neither will that of the enormously rich in this country yield any to the soil resources when once depleted.

Flowing from the West, eastward, an endless stream of the cream from the soil is moving to maintain this section, while in the near future the rapidly increasing population towards the Pacific will require all their products to provide for themselves; the corn and bran, linseed and cotton seed will be needed where produced, and the phosphates, nitrates and potash exhausted unless new deposits be found. If not, Eastern agriculture, with no new territory to develop, cannot be maintained. Then landlordism and a division into classes of rich and poor will be the final result in a more aggravated form than that already evidenced in the vicinity of towns and cities where it now is an established condition. Neither radium, diamonds, gold, silver or other precious metals will ever produce a loaf of bread. The accumulated fertility of the soil and that which may be obtained through disintegrating rocks alone can be depended upon to support life.

The several rock formations contain elements of fertility in various degrees, those of organic origin being most permanent, consisting principally of the limestone. The rich alluvial bottoms are formed at the expense of other localities from which streams flow carrying silica, lime, phosphorus, nitrates and potash in solution, and a fine sediment, retentive and friable; but these are limited in area to valleys. The granite and traps of igneous origin produce a soil rich in potash and other elements, but are slow to disintegrate and often too stony for cultivation. The various shales and sandy soils, upon which the soft woods and inferior plants grow naturally, are usually soon exhausted for want of inherent fertilizing elements. The herbage and forest growth is a certain indication of the natural fertility of the soil in the Eastern and Middle States. The soils of the Pacific coast states, parts of South America, the islands in the Pacific Ocean, of France, Italy and some other sections are of volcanic origin, once molten materials of lava, pumice and ashes, yielding some of the most productive land.

Viewing the eastern section of this country from the Allegheny Mountains it is evident that the earth, after the stratified rocks were deposited on horizontal plains, yielded to some force, internal or external, which forced these deposits thousands of feet in depth and thickness which are now found at all angles from the horizontal to

perpendicular. This disturbance was of such great magnitude and forceful enough to fault and crush under great pressure all the formations east of the Alleghenies. What the forces were that produced such dislocations is not definitely known, whether due to the shrinking of the earth in cooling or to volcanic eruptions or to both. The vast amount of ejected molten material drawn from some source far or near may have caused elevations in some places and depressions in others. West of the Allegheny Mountains and in sections where the rocks are in a horizontal position, not crushed and tilted as they are in eastern sections, the mineral oils and gases stored are hermetically sealed in porous rocks under clay deposits, remaining secure until tapped with drills.

Much time and money has been wasted prospecting for oil and gas in various localities where, on account of their volatile nature, these substances have long since escaped into air through faults and fissures produced during the shifting of the rocks. It may be worth remarking and remembering that in or near a section where displacements have occurred prospecting for oil and gas will be useless.

Gold, silver, copper and other precious metals usually occur among rocks of volcanic origin, granites and traps; this being, however, no indication that all rocks of this type contain metals of value.

There are published, in State and National geological reports, the results of many analyses of rocks and soils and, while interesting to study, they indicate what the chemist can find of the various useful substances necessary for plant production. Such results are of little practical value in agriculture, since the methods employed by plants differ so widely from those of the laboratory. The character of soil, the proper proportion of sand and clay with a few other elements and organic matter determine its agriculture value.

In reference to the climatic changes already mentioned, before the temperature of the continent became moderate and the land habitable there was a period of intense cold succeeding the tropical period during which the coal was formed. The Northern Hemisphere was covered with a great ice sheet, overtopping most of the high mountains to the north, reaching as far south as the 40th parallel near New York City, thence passing over New Jersey into Pennsylvania, trending westward in an irregular line across the continent, reaching the farthest southern point in Illinois on the 38th parallel, then passing north of the Dakotas and west to near British Columbia, thence to the Pacific Ocean and Alaska, where the glaciers yet exist, the same as around the pole, where Cook and Peary claim to have been. Darwin states that evidence was observed in the Cardilleran Mountains of South America that glaciers existed there at some period. Other writers mention New Zealand and Australia as having experienced similar conditions. Geike details observations in Scotland, Ireland, England, Scandinavia and Northern Europe, with a full description and maps of the glaciated districts in those countries. The Alpine district has been carefully studied and described by numerous visitors and Agassiz, from his observation and study in that locality, first explained to geologists of this country the cause of the drift, lakes and other evidence of a continental ice sheet. Since then, during recent years, attention has been given to the subject by many persons in many localities.

There is ample evidence that with a change of climate and the retreat of the glaciers the rivers flowed at much higher levels than at present, the river terraces indicating quite plainly where the floods reached. Here in Harrisburg, on Allison's Hill, sand, gravel and boulders, brought from a distance, are found on the surface and where excavations are made. The river here is 290 feet above tide, while Allison's Hill appears to be a hundred feet higher. Evidently when the river lowered its bed an obstruction was in its path at York Haven, where a trap dyke, hard granite, forced its way through the shale at that point, which passes from York county into Lancaster and on eastward, forming a barrier in the river, affording the river only a narrow channel and causing a natural dam, now used for electrical and other power, being one of the natural resources about which there is so much controversy.

It may be considered that some of the ideas contained in this paper are far-fetched and not related to agriculture, yet the farmers on the fertile limestone soils producing grain, as well as those who devote their energies to fruit on the granite and shale hills, and those who are in glaciated districts where dairying and fruit applies, realize the advantages afforded under the varied conditions created by natural agencies during the distant past. Editors, lecturers, and scientists who, when not engaged in practical farm work, look wise and devise and suggest methods for increased crop production without depleting soil fertility, and yet maintain an increasing population to consume the products of the soil without loss of fertility, are facing a condition and not a theory, a problem compared with the oft repeated impossibility of eating pudding and keeping it at the same time. Not until perpetual motion can be demonstrated will land be self-supporting when the products are removed, consumed and lost, will the soil become an Alladin's lamp.

The fact that the farmers of Pennsylvania spend seven million dollars a year for commercial fertilizers alone and as much more, perhaps, for manure and lime, if not necessary, would indicate that the farmers have not learned the first principles in agriculture, and would confirm, if true, the statement of Secretary of Agriculture Wilson when he states that "the worst farming in this country is done east of the Alleghenies, and agricultural land the cheapest in that locality in consequence."

REPORT ON FORESTS AND FORESTRY.

By ROBERT CONKLIN, *Harrisburg, Pa.*

Gentlemen: Your Chairman on Forests and Forestry does not have a lengthy report to present. The State Department of Forestry has, during the past year, added 88,717 acres and 12 perches of land to its forest reserves, bringing the total area acquired to January 1, 1910, to 916,569 acres and 8 perches. The average cost of this land per acre was \$2.23. In the care of the land it has 31 foresters and

about 80 forest rangers employed, only about one-fifth of the number necessary to properly care for the area held; but it is necessary to live within the appropriations granted by the Legislature, therefore more cannot be employed.

The effort thus far in the care and improvement of the reserves has been in the surveying, making roads and fire lanes, doing some improvement, cutting and also planting the seedlings that were available from our nurseries. Last year there were planted nearly a million seedlings, mostly white pine. The other species planted were Scotch pine, larch, Norway spruce, oaks, walnut, hickory, ash, catalpa and Carolina poplar.

In our nurseries, located at Mount Alto, Greenwood Furnace and Asaph there are now about 5,700,000 young seedlings, of which 2,000,000 will be available for planting out this Spring. Each nursery will be enlarged this year in order that we may be able to comply with the provisions of the Act of Assembly passed at the last session, allowing the Department to furnish at cost to persons seedlings for individual planting. Upon a number of the reserves there has also been started by the foresters small nurseries for the purpose of raising young trees to be set out upon those reserves.

Thus far in this State there has been very little effort in the way of forest culture by the individual. Many inquiries have come to the Department during the past year, however, by individuals and corporations who are considering the matter of planting up their rough lands with forests, and I am in hopes that many of them will do so shortly. It would be a great pleasure to the Department if it were possible at once to supply them with the seedlings necessary to start the work. Every farm should have its woodlot, and there are few farms but what have an acre or more of land that is unprofitable for cultivation and which should be planted with trees. Every acre of land in the farm should produce a revenue, and if the rough land is put in trees, the crop produced will be as valuable, and probably more valuable, than any other crop that can be raised upon it.

There are thousands of acres of land in this State that are being neglected by the owner. He should turn his attention to this waste land at once and put it in trees in order that it may become a source of revenue to him. It was for the purpose of encouraging the individual that the Act granting the Department of Forestry the authority to furnish trees at cost was passed.

Forest fires were very destructive during the past two years because of the drouth that prevailed. If it were possible I should like

I want to say also that the Department would be glad to have applications from farmers who have an acre or two of the rough land that they desire to plant up, in order that we may file them and be prepared to ship to them such trees as they will need. The cost of these trees will be probably about \$2.75 a thousand for conifers and hard wood and broad leaf trees will be a little less than that. Just exactly what the cost will be we cannot determine as yet. We shall be glad to encourage the farmer in planting up the little pieces of rough land that he has on his farm. If he has only half or a quarter of an acre, let him put it in trees. It is going to produce something. It is not worth much for anything else, and in that way he will be getting a revenue for his land.

CHOOSING A VOCATION AND WHAT CAME OF IT.

By D. W. LEE, *Bedford, Pa.*

It has been said by James Russell Lowell that no man was born into the world whose work is not born with him. There is always work and tools to work withal for those who will, and blessed are the horny hands of toil. The busy world shoves angrily aside the man who stands with arms akimbo set until occasion tells him what to do, and he who waits to have his task marked out shall die and leave his errand unfulfilled; and each one as he comes to his task is expected to take it and march in the great procession of life and time as they pass along. And we believe that it makes a great difference whether we take it up cheerfully or otherwise, for we shall pass this way but once; therefore any good that we can do to make the world better or any kindness that we can show to any of our fellow-human beings let us do it as we pass along, for we shall not pass this way again. Let us take our occupation as we find it and let us follow it cheerfully and hopefully, giving to it our best powers and abilities, not entirely for our own selfish up-building or supporting, but that we may fill the place that we occupy in our own special locality and community to the end that it may be bettered by the life and work that we have been able to do in it; that truth and honesty, education and righteousness, may be the fruits of our efforts and lives and God, our Maker and Preserver, honored and glorified by them.

This matter of occupation is not a simple matter of choice with all of us. Necessity confronts most of us and compels us to earn our

between God our Creator and we his subjects was taken away, and so God now through our Lord Jesus Christ commands all men everywhere to be zealous in business, fervent in spirit, serving the Lord. He also promises great assistance, guidance and help to all who put their trust in Him and who continue faithful to the occupation that has come to them, giving it their best attention, to the end that their own condition in life may be bettered and that others may be cheered and comforted by their example.

Now, as we look over the field, we see men who, forty-five years ago, chose agriculture for an occupation and, not understanding the financial condition of the country at that time, bought farms at the then inflated prices caused by the great civil strife that had just ended, hoping that the prices of farm produce would still remain correspondingly high until they would get out, many of them giving heavy mortgages on their investments, which afterwards became a great load to carry; for as the then inflated currency of the country rose from sixty cents on the dollar to one hundred cents, farms and farm produce depreciated in the same ratio, or even more, for a while until after the years of 1873 and 1874, and then, as most of us remember, for at least eighteen or twenty years the value of farm produce was very uncertain and values in other lines equally so, nothing but actual supply and demand helping the situation in the rural districts. Those were discouraging years for the Pennsylvania farmers, but with all the discouragements in the way, some pushed all the obstacles aside, paid off the mortgages and are still living on these same farms unencumbered and very much improved, in the meantime and at the same time found time to help with every progressive movement in their particular part of the country.

And now as we look over the field we think we see a grand and cheering prospect, for the future Pennsylvania is looking for her brightest and best sons to till her soils, real men of education, of strong physical bodies, with will power enough behind all to move them to doing the things necessary to keep her in the forefront of states, where she belongs, for no matter what she has done in the past, we still claim that she has not yet reached half her capacity in agricultural production. With her money values at par; with the Department of Agriculture to help in the way of institutes and movable schools of agriculture carried into nearly all the corners of the State; with our State College to educate and train in all special lines, free of tuition; with Grange organizations in a great many parts of the State to break down the isolation of the rural districts and help along social lines; with increased market demands and with better facilities of getting to market; shall she not have the best of talent and muscle to cultivate her hills and valleys? Let us hope.

And now we would like to invite our farmer friends to try and beautify a little, to put up little neater fences, to straighten up some of the little crooked streams that spoil some of our fields and spoil the beauty of the view. These things together brings success with the occupation which is the culmination of our effort.

ANIMAL HUSBANDRY IN PENNSYLVANIA.

By PROF. W. A. COCHEL, *State College, Pa.*

Members of the State Board of Agriculture, Ladies and Gentlemen: I may say that I feel that it is a very great honor to be asked to talk before the State Board of Agriculture on the subject of "Animal Husbandry in Pennsylvania." We only have a very short time to devote to this subject which, if we were to go into it in all of its details, is large enough and broad enough to occupy the whole evening; so I will only attempt to touch it in a few spots.

I may say, frankly, that this is my first public appearance, aside from being at State College, in the State of Pennsylvania. I have been away from here for about two generations. My grandfather and grandmother on my father's side were Pennsylvanians, so that only having been here personally for the last four or five weeks it is impossible to say so much that I can back up with actual observances in regard to Animal Husbandry in the State. I may say this, however, that the livestock history that has been taught me and the things that I have been able to learn from reading and observation in the West, have shown me that Pennsylvania was originally one of the greatest livestock states in the Union. The first marked improvement in cattle, in hogs and in sheep in the United States was accomplished in the State of Pennsylvania; but to-day when we consider Pennsylvania as a livestock state it does not really rank with some of the others in the Union. This is a peculiar condition. We are more nearly located to the great consuming centers of the United States than any other farming community in the world.

I will deal especially with the production of meat animals. There is more meat consumed in the states of Pennsylvania and New York than there is in any other three states in the United States; and yet in proportion to their area there is probably less meat produced. This has been brought about through two or three reasons. It is not because our country is not adapted to the production of livestock. It is repeatedly shown in every neighborhood that there is someone who has taken a fancy to meat-making animals and he is making a success of it. When our Western country was first settled, land was so cheap and produced such crops that they could not do much with them. They were far from market and isolated to some extent; and for that reason the meat-making animals enabled them to market their products in a more concentrated form. With land at two and a half to three dollars an acre in Illinois and Missouri, necessarily people who had lived here on the farms for a generation could not compete with these men in the production of meat animals. But to-day we find the same conditions confronting the people of the Central West that confronted this State one or two generations ago; that is, their lands have advanced so much in value that the farmer who is producing

beef in Illinois, Missouri, Kansas and Nebraska, the great meat-producing sections of the country, is not able, if he charges the market value of his crops and the cost of his cattle when he begins to feed them, all through to the finished product, to show a very great profit unless he considers the by-products, the manure and hogs, in maintaining and upbuilding the fertility of his soil. So that today, for the first time in the history of the country, the man who is making beef is really getting a little bit more than the cost of production, over and above the by-products of the feed lots; and as soon as that condition confronts us the first thing we have is a boycott on the meat, which the papers are full of to-day.

Present prices have been brought about by the inexorable law of supply and demand. We find from the period of 1880 to 1900 there was an increase in the population of the United States of 56 per cent.; in the same period there was an increase in the number of cattle produced of approximately 29 1-2 per cent. In other words, the population is growing more rapidly than the production of beef. Since 1900 it is estimated that our country has increased in population approximately 20 per cent., and in that same time there has been no increase in the production of meat-making animals, hence the present high prices of meat; that is, the demand has more than caught up with the supply. Whenever we get to that condition where we can make beef in Pennsylvania in competition with people who are on land just as valuable as ours, then we are getting to the place where we can go back into the production of meat.

The production of beef in any community, whether in Illinois, where they raise the greatest corn crops in the world, Indiana, Iowa, no matter where we take up the production of beef, we must consider it from the standpoint of the upbuilding and maintaining of the fertility of the soil, which is the greatest problem before the people of America. If we can consider our meat-making animals, machines for the marketing of crops, and secure through them as much for the crops and a little for labor, then we are making a large profit on the production of meat. That is the attitude that we are taking toward our experimental work in feeding at State College; we are striving to demonstrate means and methods by which we can obtain equally as much for the crops we feed to the farm animals as we can by selling them off the farm, and at the same time get a little profit for the labor necessary in feeding.

Having gone out of the production of beef for one or two generations in this section, there are two things for us to do in order to get

steer does not digest his food better than the scrub, but that it takes less feed to maintain him in proportion to live weight, and his great advantage is in being able to consume more in proportion to his weight than the scrub animal. In other words, we ought to select animals expressly for feeding purposes, and that holds equally good in hogs, cattle and sheep. The more we can get an animal to eat above maintenance, the more production we will get and in that way cheapen the total cost of our finished animal.

The second great advantage offered by an animal that is bred for beef purposes in comparison with one bred for no purpose is, that it will dress out better and yield a higher proportion of the cuts of beef that bring the high prices on the market. The highest priced meat in beef lies above a line drawn from the point of the shoulder back, which includes ribs, the loin and upper part of the round and rump. The chuck ribs of the well finished steer are also good cuts. Below this line the plate, brisket and flank are cheap cuts. So that in selecting our beef animals, we want to have them carry as much back and loin and just as much of the high priced meat as we can in proportion to the cheap meat, and in that way we can get a higher price when we sell them. It costs more to produce cheap beef than it does the meat on the well-bred steer, and you will get less out of him than the well-bred steer. If you consider the problem from these two standpoints you can cheapen the product and there will necessarily be a greater percentage of profit.

The next point in the production of meat animals at the present time, is the selection of rations. During the past four years I have devoted my time to experimental work in feeding beef cattle. We have been able to show in our work that clover hay is worth one-half more per ton than timothy hay to feed to beef steers. We find that in Indiana there are more people feeding the timothy than clover hay to beef cattle. In the feeding of roughage, we have been able to show a marked improvement in the ration. We have been able to show that the use of cotton seed or linseed meal, these commercial concentrated feeding stuffs, has enabled us to get an increase of 5 to 15 cents per bushel for corn than when we fed similar rations without it.

We have also been able to show that silage is one of the most economical feeds for the production of beef. Intelligently fed it imparts a high market finish. That brings up in a very limited way just a few of the things that we expect to work on in this State, that is to try to determine the rations that we can select on our farms in Pennsylvania that will produce meat at the lowest possible expense and get the highest possible finish on the animals, the marketable finish that the market men are willing to pay for. In a measure, what is said in regard to beef cattle is true in regard to hogs and sheep; the same principles underlying. We want to select an animal that will produce what the market demands, and select feeds that will produce that animal at the lowest possible expense. We have a little different condition in feeding hogs than in cattle, however. Most of the hogs fed are farrowed on the farm where they are fed. There is not the traffic and dealing in stock hogs as in stock cattle, so that we have to consider every pound that that hog gains while he is on our farm when we sell him. With cattle we buy at four to four and a half cents a pound, when we feed them for three, four, five or six months, we expect to get a margin over and above the

cost of cattle, and unless we do there is no profit. With corn at seventy cents a bushel, a steer will have to increase in value thirty to forty-five cents per hundred every month fed. With a hog he has to make a pound at a lower cost than what he finally sells for. We are going to try to determine methods of management of hogs in order that we may keep them thrifty and healthy, and utilize to advantage the forage crops we grow on the farm. I feel confident in saying here to-night that if the farmers of Pennsylvania would utilize all of the land that is going to waste in the State at the present time, that is not returning an adequate profit in the growing of grass, clovers, alfalfa and other good crops, and would make an intelligent use of the feeds we have at hand by selecting supplements to the best possible advantage, that we can double the production of meat in the State of Pennsylvania to-day without any question whatever.

The question of horse production has been so thoroughly covered to-day and at your previous meeting that I will not touch upon it except in a limited way. I will say this, that we ought to produce in Pennsylvania every horse we use here, whether for carriage, road, draft or saddle purposes. We have a soil that is especially adapted to the production of horses, and the only thing necessary is to follow proper lines of breeding and we can produce horses equal to any we can ship in. I lately attended a sale of horses shipped in from the West that sold at an average of \$226.00 per head, and there was not a sound horse in the bunch. Now, when such a condition as that confronts the farmers of Pennsylvania I do not see how they can afford to pay the prices for those horses to work on the farm when they can produce immensely better horses by following the same methods of breeding and management in production and save two or three profits from the middlemen and expenses of shipping, freight, etc., and risk from disease, all of which go in with the price of \$226.00 for unsound horses. The thing we have to do in the horse business in this State is to decide in each community upon something that is adaptable to the community, some breed or type that has been agreed upon in that territory, and select registered stallions and build up the horse industry in the State. I believe in all the farm livestock we have there is a greater chance of improvement in horses and beef making animals than anything else in the State. The hogs are fairly good, the dairy cattle not excelled, and our chief endeavor will be to stimulate interest in the horse-producing and beef-feeding business. This may seem to you a rather broad field for a man to take, but with reference to this beef part of it especially, where the farmers have gone out of any line of business, it seems there is a good economical reason back of it. It may be there was, but the conditions in other states have changed so much, and the price of beef will always be higher than it has been in the past unless our country goes to the bad financially in every way. The time is ripe for us to make some improvement, start along new lines and breed up a lot of cattle that are useful for the purpose. We find the Western ranges supplying the State of Pennsylvania to-day with practically three-fourths of the cattle fed in the State, are gradually closing up, the steers in the West are getting to be worth more and more each year, and if any of you are feeding cattle, you know it is more difficult every year to get a load of uniform beef type that will make you

a profit in the feeding line. The quality of the cattle of the country as a whole is decreasing, the numbers decreasing and the prices increasing. When these three factors are brought together it means we can produce them in this section just as cheaply as they can in the West, and the man who begins now and starts in at the bottom is certainly going to get his reward.

There is a question that usually comes up when we discuss the relative merits of beef cattle; that is, why feed beef steers when we can buy dairy cows and make more money out of it. You undoubtedly can, but the question of labor is one we cannot get around, and the man who devotes his time exclusively to the dairying must depend upon hiring the labor he intends to use on the farm or limit his operations to a small scale; while on the other hand, the man who feeds beef cattle can market a large amount of crops on any one farm with little outside help, and this is the reason people in any section will go into the feeding of beef cattle instead of dairying; it is the relative amount of labor and hired outside help required which determines the matter. If we had all the labor we needed and could get it at a very reasonable price, there would be no use in the world of the beef man attempting to compete with the dairyman in the utilization of crops. But the conditions in Pennsylvania are the same as elsewhere. The boys are going to the city, off the farm, and then the father has to go out of the dairy business. We find also, in making a very careful study, that most every dairyman looks forward to the time when he will have accumulated enough to quit the business and not have to work the rest of his days at it, while the beef cattle man always looks forward to the time it will be possible to handle more cattle. He never looks forward to the time when he can quit. This is simply due to the difficulty encountered in securing labor for dairying.

**ABSTRACT OF PROCEEDINGS OF THE FIFTH ANNUAL
CONVENTION OF THE FRUIT GROWERS ASSOCIA-
TION OF ADAMS COUNTY, HELD DECEMBER 15,
16 AND 17, 1909.**

OFFICERS.

President,	Robert M. Eldon,	Aspers
Vice President,	A. I. Weidner,	Arendtsville
Recording Secretary,	Josiah W. Prickett,	Biglerville
Corresponding Secretary,	Edwin C. Tyson,	Flora Dale
Treasurer,	Wm. S. Adams,	Aspers

EXECUTIVE COMMITTEE.

Robert M. Eldon,	Aspers
Josiah W. Prickett,	Biglerville
Chester J. Tyson,	Flora Dale
Robert Garretson,	Aspers
John H. Peters,	Bendersville

ORCHARD FERTILIZATION.

**PROF. J. P. STEWART, Department of Experimental Horticulture, Pennsylvania State College,
State College, Pa.**

The problem of successful orcharding is to secure and maintain a balanced treatment. Many factors are involved,—moisture, plant food, light, protection (from enemies, frost and disease), correct varieties and location, and correct business management. None can be neglected without danger of loss, and it is the weakest factor that limits the crop. The limiters, therefore, must be found and corrected. Money and energy spent on factors already relatively strong are likely to be wasted, while on the other hand, the weak factors will respond to

D. M. Wertz,	Mont Alto fine sandy loam, York Imperial and Jonathan,	10	160
Mrs. S. B. Brown,	DeKalb stony loam,	York Imperial and Baldwin,	11 & 21
J. H. Ledy,	Mont Alto loam,	York Imperial and Gano,	16
J. A. Nicodorus,	Hagerstown clay loam,	York Imperial and Albemarle,	10 & 14
J. R. Sleek,	DeKalb shale loam,	York Imperial, Jonathan, Ben Davis and Gano.	7
F. H. Fassett,	Fine sandy loam,	Northern Spy and Baldwin,	37
A. D. Strode,	Chester loam,	Grimes, Smokehouse and Stayman Wine-sap.	7-9
St. Paul's Orphans' Home,	Volusia silt loam,	Northern Spy, Baldwin and Ronas,	120 & 105
J. B. Johnston,	Volusia silt loam,	Baldwin,	21
F. T. Mynard,	Upshur loam,	Baldwin and Fallawater,	15
			120 & 1

The first three experiments, 215, 216 and 220, comprise what we call our straight fertilizer experiments; the next four are experiments on cultural methods, with and without manures; and the last four are a combination of fertilizer and cultural methods experiments. Each of the fertilizer experiments contains sixteen plots of ten trees each. The treatments are shown in Table II. The symbols N, P and K refer to nitrogen, phosphate and potash; and they are applied at the rates of 50 lb. N., 100 lb. P₂O₅ and 150 lb. K₂O per acre in all cases. Plots 5 and 6 compare the muriate and sulphate as a carrier of potash. Plots 11 and 12 compare acid phosphate and "floats" as a carrier of phosphoric acid (phosphorus pentoxid, more correctly). The manure is applied at the rate of 12 tons per acre and the lime at 1,000 lb. per acre. All applications are made annually.

The combined results to date of the first three experiments are shown in Table II.

TABLE II.
Influence of Fertilizer on Yield, Color and Growth.

Plot.	Treatment.	Yields 1908-9. Lb.	Per cent. benefit.	Yields 1909. Third Yr. Lb.	Per cent. benefit.	Per cent. of apples colored 1 or more. 1908-9.	Per cent. benefit.	Ave. Increase per tree in trunk girth, in inches, 1907-8.	Per cent. benefit.
1	Check,	4,648	-----	1,306	-----	69.2	-----	8.29	-----
2	N P	6,887	78.1	1,770	51.2	47.9	-28.5	8.54	8.9
3	N K	5,658	82.8	1,409	36.4	57.	-14.5	8.68	19.1
4	Check,	2,313	-----	897	-----	72.7	-----	3.18	-----
5	P K	3,577	62.5	1,441	56.5	69.8	1.7	3.34	3.8
6	PK ₂ S ₄ O ₄	2,773	32.	1,064	76.3	77.2	8.6	3.43	5.1
7	Check	1,998	-----	1,067	-----	59	-----	3.29	-----
8	N P K	5,547	67.4	1,561	31.3	41.6	-20.3	3.97	18.2
9	N	4,700	81.2	2,675	104.2	48.8	-21.1	4.08	19.4
10	Check	2,598	-----	1,481	-----	67.8	-----	3.48	-----
11	Acid P.	2,833	6.26	2,126	52.2	69.3	8.3	3.49	-1.7
12	Raw P.	1,548	-36.6	1,073	-21.3	75.3	11.	3.39	-8.9
13	Check	2,200	-----	1,327	-----	62.5	-----	3.08	-----
14	Manure	4,793	126.3	3,423	178.5	56.0	-9.1	4.30	21.6
15	Lime	1,588	-21.7	895	-21.	66.7	-9	3.78	9.6
16	Check	1,543	-----	1,034	-----	70.2	-----	3.36	-----

Striking things shown here are the strong beneficial effect of manure and of nitrogen on yield and growth, with an accompanying harmful influence on color. Plots 6 and 11 show surprising gains in the yields of the third year. Raw phosphate and lime continue to show deficits in every way except in color for the former and in growth for the latter. We can hardly see any reason for this harmful effect in the case of the "floats" and suspect that it is due to some temporary condition which will disappear later. The same may be true of the lime effect, though the reports of "Lime poisoning" made by Dr. Headon in Colorado Bulletin 131 are worthy of consideration in this connection. It is also worthy of note that the plots which have made the best yield have also made the best growth, thus showing that reasonable amounts of yield and growth are not antagonistic but rather are associated.

A puzzling condition appears in the fact that wherever nitrogen has been applied in combination with other elements, the benefit decreases in a third year, while in plot 9 where it was applied alone the benefit in the third year increases distinctly. This is partly explainable in the larger yields of the former plots last year, thus bringing them more strongly under the operation of the biennial bearing habit.

Also the difference in yield between 8 and 9 may be traced directly to a deficit of at least 1,000 lb. that occurred this year in plot 8 of Experiment 220. This deficit was not due to the absence of apples on the trees. On the contrary an excessive number of fruits were started on this plot, despite its heavy crop of last year, and this very fact, coupled with the excessive foliage and extreme drought of the current season, almost prevented development in the apples. Plot 9 of course was subjected to similar conditions, but to a lessened degree in every way. Its original set of fruit and its foliage were less and its moisture situation is hardly as severe as that of plot 8. Thus, while some of the present results are undoubtedly entitled to the rank of "posers," yet they are not entirely beyond partial explanation at least; and at any rate they should not be permitted to cloud the main facts, which are given in the paragraph above.

In Table III we have another set of results from the fertilizer portions of Experiments 336, 338 and 339, which have been running for two years only. The applications are the same as in the experiments above.

TABLE III.
Influence of Fertilizers on Yield and Color.

Expts. 336, 338, 339.

(a) Yields in Pounds, 1908-9.

	1. Check.	2. N P.	3. N K.	4. Check.	5. P M.	6. N P M.	7. Check.	8. Manure.	9. Lime.	10. Check.
1908, 1st year, ---	562	960	748	1,118	846	2,178	1,067	2,338	8,111	2,748
Per cent. benefit,		15.1	19.8	.....	-23.2	100.9	.....	46.7	48.1	.....
1909 totals, -----	1,067	6,435	6,307	2,508	3,803	7,212	2,426	4,000	2,349	1,720
Per cent. benefit,		312.7	213.6	.....	53.3	193.4	.....	109.7	19.9	.....

1909.

(b) Color per cent. of apples colored $\frac{1}{2}$ or more.

Ave. per cent. color.	57.3	40.—	39.8	49.4	46.5	38.0	49.7	49.0	50.3	54.8
Per cent. benefit,		-14.6	-12.2	.....	-8.	-11.6	.....	-2.4	-2.8	.....

In Tables II and III we have had results from various combinations of fertilizer elements, as well as some from certain materials used singly. Those results being direct from the trees may be considered a close expression of the values thus far of the various combinations used. In many cases, however, we may wish to know which

is the more active element in a given combination and approximately what values are to be assigned to each of the elements in it. For example, in plot 2 of Table II we find a benefit of 78.1 per cent. resulting from an application of nitrogen and phosphate. Here the question arises as to how much of this effect was due to nitrogen and how much to phosphate. Any answer to this can be of course only an approximation of the truth and hence the values obtained and shown in the following table are not to be taken too literally. They are the nearest approach to the correct values, however, that we are able to obtain at this time and they were derived in the manner indicated in the footnote to the table.

TABLE IV.
Influence of Fertilizer Elements on Yield, Color and Growth.

Expts. 215, 216, 220.	Yield.		Color.	Growth.
	1908-9.	1909.	1908-9.	1907-9.
Nitrogen, in combination, -----	49.2%	15.55%	-19.35%	12.1%
Nitrogen, alone, -----	81.1	104.2	-21.1	19.4
Ave. Influence of Nitrogen, -----	65.9	59.9	-20.93	15.8
Phosphate, in combination, -----	23.9	35.65	-3.13	3.2
Phosphate, alone, -----	6.2	52.2	3.3	-1.7
Potash, in combination, -----	33.6	20.85	4.85	7.0
Manure, alone, -----	138.3	178.5	-9.1	21.6
Lime, alone, -----	-21.7	-21.	.9	9.6

Expts. 336, 338, 339.	Yield.		Color.
	1909 (2nd year.)		1909.
Nitrogen, in combination, -----		236.5%	-11.9%
Phosphate, in combination, -----		76.2	-2.7
Potash, in combination, -----		-22.9	-.3
Manure, alone, -----		109.7	-2.4
Lime, alone, -----		19.9	-2.8

These results, being derived from those in tables II and III, are naturally not materially different, as a whole, but the values of the individual elements stand out more sharply.

Nitrogen and stable manure show striking beneficial effects on both yield and growth and characteristically harmful effects on color. The effect of the manure is greatest in the third year of the first three experiments, while that of the nitrogen is astonishingly great in the second year of the three later experiments.

Phosphates are showing considerable value on yield, especially when used in combination with other materials. Their effect on color and growth is apparently undecided, as 3 per cent. variations from the normal are readily attributable to limitations in our methods of determining values. Potash, in combination, has shown fairly good effects

on yield and growth in the first experiments, but has apparently proved rather distinctly harmful in the second three; and considering the results in all six experiments its value in improving color is very questionable.

Lime in the first three experiments shows a distinct deficit in yield, and no advantage in color, but apparently a fair increase in growth. In the other experiments an apparent benefit in yield is shown. This, however, is due to an unusual increase on the lime plot of experiment 339, an increase which was due probably more to a favorable moisture situation this year than to any effect of the lime. It is surely a significant fact that in five out of six places thus far, lime shows either no effect or a distinct deficit in yield.

It will be noted that practically none of the treatments have materially improved color while a number of them have distinctly decreased it. This reduction in color is undoubtedly associated with *delayed maturity* and a *diminished light supply to the fruit*, the latter being due to an increase in the density of foliage following the application of the fertilizers. The value of sunlight in developing redness in apples is scarcely appreciated. In a test conducted during the fall on York Imperial apples it was found that exposure to sunlight after picking increased redness by over 35 per cent, while apples confined in the dark, or exposed to electric light and under identical conditions otherwise, showed practically no increase in redness. *Maturity in sunlight* on the trees is undoubtedly the great influence affecting redness in fruit, and when soil ingredients apparently affect it, their effect is produced indirectly through a modification in the main influence.

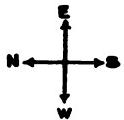
In Table V, we have the financial value of fertilization as shown in some of our most striking results of this year.

TABLE V.
Financial Value of Fertilization.

Expt. 221, 1900, (3rd Yr.)	Yield. Lb.	Bushels per A.	Value at 50c.	Cost of Fertilizer.	Net gain per acre.
Unfertilized, plots 4 and 7,	19,448	194.5	\$97.25		
Com. fertilizer, plots 6 and 9,	47,028	470.0	235.00	\$13.00	\$124.75
Manure, plots 5 and 8,	48,560	486.5	242.75	15.00	180.50
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Expt. 220, 1900, (3rd year.)					

It is to be noted that the net gains are obtained after deducting both the cost of the fertilizer and the value of the unfertilized crop, also the fruit here is valued at 50 cents per bushel, while the actual prices obtained for it varied from 50 cents to \$1.25 per bushel; and any increase in the appraisement of the fruit of course will proportionately increase the net gain. It is also to be noted that variations in the factors of tillage, spraying and pruning produced no material effect on the size of the crop, since the treatment of all plots in these respects was uniform.

Figure 1.



	K	J	I	H	G	F	E	D	C	B	A	ROW
PLAT I	
II	
III	
IV	
V	
VI	
VII	
VIII	
IX	
X	
XI	
XII	
XIII	
XIV	
XV	
XVI	

CHECK

NITROGEN & PHOS.

NITROGEN & POTASH

CHECK

PHOS. & POTASH (KCl)

PHOS. & K₂SO₄

CHECK

N.P.K.

NITROGEN

CHECK

P (ACID ROCK)

P (RAW ROCK)

CHECK

STABLE MANURE

LIME

CHECK

Such striking results as these of course are not to be expected everywhere. They evidently occurred here because plant food was the crop limiter in these orchards. For any given case this can only

responding strongly to fertilization, while some older ones have proved unresponsive. The big fact is that when such results as these are obtainable anywhere, it raises a strong suspicion that similar benefits may be obtained in many other orchards. And these results show beyond peradventure that in some orchards apple trees, like other plants, respond strongly and directly to applications of plant food.

EXPERIMENTS ON CULTURAL METHODS.

Closely associated with the question of plant-food, is that of soil moisture. It is the available moisture that determines in a large measure whether or not apples shall attain their proper size; and it is largely to modify moisture supply that the various cultural methods are followed. The plan of our experiments comparing these methods is shown in Figure I.

PLAN OF EXPERIMENT ON CULTURAL METHODS AND MANURES.

As shown in the figure, this experiment tests four methods of soil management, viz.: clean tillage, tillage and cover crop, sod mulch, and sod. Each treatment occurs both without fertilization and with it. The stable manure is applied annually at the rate of 12 tons per acre; and the commercial fertilizer at the rate of 30 lb. of nitrogen (NO), 60 lb. phosphorus pentoxid (P_2O_5), and 100 lb. of potash (K_2O).

On the mulch plot all herbage remains in the orchard, the first cutting being raked to the trees as a mulch, and an additional mulch of old straw, swamp hay or buckwheat straw at the rate of about three tons per acre is applied annually. In this latter respect it differs from the so-called "Hitchings plan," and as a conserver of moisture it is undoubtedly very much better than that plan. On the sod plot, the first cutting of herbage is removed from the orchard and the second is left where it falls. The tillage plots are all cultivated until early in July, when those receiving the cover crop are seeded to crimson clover, hairy vetch or medium red clover and alsike, either singly or in combination. The results to date are from the unfertilized plots of the young orchards, and are shown in Table V. These results are those in later tables on young orchards have been obtained by combining the results from three orchards, whose age as noted in Table I ranges from seven to sixteen years.

TABLE VI.

Effect of Cultural Methods on Yield, Color, Size and Growth, without Fertilization.

Expts. 217, 218 and 219. Young Orchards. (a) Yield.

	I. Clean tillage.	IV. Tillage and cover crop.	VII. Sod mulch.	X. Sod.
1907-9.				
Totals, 3 years, -----	15,048 lb	16,067 lb	17,776 lb	18,880 lb
Ratios, -----	108.4 100.	115.7 106.7 100.	128.1 118.1 110.7	100.

1909.

(b) Color. Per Cent. Apples Colored $\frac{1}{2}$ or More.

Average per cent., -----	75.4 100.	81. 107.4	81.5 106.1	86.6 113.5
Ratios, -----				

1908-9.

(c) Size. Average Weight of Apples.

Average weight, -----	4.5 oz. 100.	4.74 oz. 105.3 100.	4.91 oz. 109. 103.6	4.60 oz. 104.2
Ratios, -----				

1907-9.

(d) Growth. Increase in Trunk-girth.

Average increase, -----	4.88 in. 122.3	4.14 in. 115.6 100.	4.29 in. 119.8 103.6	3.58 in. 100.
Ratios, -----				
.				

In these results, the mulch system is first in yield and size of apples, second to sod on color, and second to clean tillage by a slight margin on growth.* It has surpassed the cover crop method on every phase and in total ranking is plainly first thus far in the combined results of this group of experiments. Reserving judgment on the relative merits of these systems for the present we will turn to consider the data from a similar experiment in an older orchard,—that of Mr. Fassett, in which the trees are now 37 years old. The

TABLE VII.

Effect of Cultural Methods on Yield, Color, Size and Growth without Fertilization.

Expt. 221, Mature Orchard. (a) Yield.

	IV. Tillage and cover crop.	VII. Sod mulch.
1907-9.		
Totals, 3 years, -----	34,269 lb.	23,294 lb.
Ratios, -----	147.1	100.

1908-9. (b) Color. Per Cent. Apples Colored $\frac{1}{2}$ or More.

Ave. per cent. of color, -----	57.4%	87.5%
Ratios, -----	100.	158.4

1908-9. (c) Size, Average Weight of Apples.

Average weight, -----	4.75 oz.	5.04 oz.
Ratios, -----	100.	106.1

1907-9. (d) Growth, Increase in Trunk-girth.

Average increase, -----	2.9 in.	1.82 in.
Ratios, -----	219.7	100.

From the above results it will be noted that, in the mature orchard, tillage with a cover crop for three years has been far superior to sod mulch in yield and growth, having borne nearly one and a half times as much fruit and showing more than double the increase in growth. In color, the mulched fruit excels by more than 30 per cent., and in average size of apples it excels by about 6 per cent. This last fact is undoubtedly connected with the smaller crop on the mulched trees.

The results of Tables VI and VII are apparently contradictory.

concusion is corroborated by moisture determinations made by Shutt, of Ottawa, Canada, in 1905 and 1906. He also has found that leguminous plants, particularly those of dense and matted growth like hairy vetch, are much less severe in their drain on soil moisture than the grasses; and that the shade of the growing vetch is a better moisture conserver than the mulch formed by cutting and leaving it in place. In other words, the loss by capillarity and surface evaporation from the practically bare ground was greater, under the conditions at Ottawa, than the transpiration through the legume.

The cover on our mature orchard is grass only, while on the young orchards a scattering growth of alsike or medium red clover has been maintained in addition.

In further explanation of the difference in effectiveness of the mulch and cover-crop methods in Tables VI and VII, we may call attention to the hastening influence on bearing, which sod undoubtedly exerts under favorable conditions. This was shown in our results of last year, where sod on these same three orchards surpassed clean tillage in yield of 13 per cent. It is also shown here later, especially in the sod-manure plot of Table IX. But the fact that this sod influence can be easily overdone and made to disappear under unfavorable conditions, is clearly shown in our results from the unfertilized sod plots of Table VI.

The next table is introduced to show the effect of adding fertilizers to the four cultural methods. All unfertilized plots are excluded from this table, and the yields given include both the manured and commercially fertilized plots under each method.

TABLE VIII.

Influence of Cultural Method on Yield, with Fertilization.

Expts. 217, 218, 219. Young Orchards.

3 & 8. Clean tillage.	5 & 6. Tillage and cover crop.	8 & 9. Sod mulch.	11 & 12. Sod.

As compared with Tables VI and VII, these results show a marked leveling effect from addition of fertilizers. In other words, the applications of plant food have tended strongly to reduce or even nullify the differences due to cultural methods. This effect was also very distinct in the appearance of the trees in the field.

A consecutive increase in productiveness following the addition of plant food has been very marked in some cases. For example, the mulched plots of Experiment 221, receiving manure and commercial fertilizer, in 1907 produced 3,050 pounds of fruit; in 1908, as seen in the table, they produced 10,351 pounds; and in 1909, 22,545 pounds. And this occurred on plots receiving no tillage.

FERTILIZATION FOR DIFFERENT CULTURAL METHODS.

The question often arises as to what is the best form of fertilizer to accompany different cultural methods. This question is partially answered by the data in Table IX.

TABLE IX.
Effect of Manures on Yield.

Expts. 217, 218, 219.

	Unfertilised.	Stable manure 13 T. per acre.	Com. fertilizer. 30-50-100 lb. per acre.
Season 1908-9 (2nd and 3rd Yr.)			
Clean tillage,	18,888 lb	21,605 lb	28,022 lb
Tillage and cover crop,	14,560	30,583	20,681
Sod mulch,	15,708	28,078	20,408
Sod,	11,706	24,773	17,939
Totals,	55,656	90,687	68,040
Ratios,	100	162.8	147.4
		110.5	100.
Expt. 221.			
Tillage and cover crop,	38,119	31,924	35,502
Sod mulch,	21,001	35,306	35,370
Totals,	54,210	67,320	68,872
Ratios,	100.	124.8	117.8
		105.4	100.

This table shows the influence of manures on yield when used in connection with different cultural methods. It will be observed that in every case except one the yields from the fertilized plots have surpassed those from the unfertilized. And in the one exception the yields on the corresponding fertilized plots this past year were more than double the yield on it. In total effect, considering all

treatments, the fertilized plots show a nice per cent. of increase over the unfertilized; and the stable manure at the rates applied shows a small gain over the commercial.

Examining the data still more closely, we see that in every case on the tilled plots commercial fertilizer has surpassed the manure, while on the untilled plots the reverse is true. In other words, the present data indicates that, from equal values of manure and a proper commercial fertilizer the best results are obtained by using the manure on sod or mulch areas, and reserving the fertilizer for use in connection with tillage. Either material, however, may be used satisfactorily and it is very probable that in any case a more or less regular alternation can be made more successful than anything else.

TABLE X.
Effect of Manures on Color, Size and Growth.

A. Expts. 217, 218 and 219. (a) Color. Per cent. Apples Colored $\frac{1}{2}$ or More.

	Unfertilized.	Stable manure.	Corn fertilizer.
Average per cent.,	71.2	61.9 —9.3	69.4 —8.8
Per cent. benefit,			

(b) Size. Average Weight of Apples.

Average weight, ounces,	4.71	4.99	5.25
Ratios,	100.	106. 100.	111.5 105.2

(c) Growth. Increase in Trunk-girth.

Average increase, inches,	4.12	4.3	4.48
Ratios,	100.	104.1 100.	107.5 103.

B. Expt. 221. 1908-9. (a) Color. Per Cent. Apples Colored $\frac{1}{2}$ or More.

Average, per cent.,	72.5	68.1	73.5
Per cent. benefit,		—4.4	1.

(b) Size. Average Weight of Apples.

Average weight, ounces,	4.89	5.42	5.33
Ratios,	100.	110.8	109.

(c) Growth. Average Increase in Trunk-girth.

Average increase, inches,	4.22	5.86	4.92
Ratios,	100.	189. 10.1	116.6 100.

Table X shows the effect of manures in both young and old orchards on color and size of fruit and on growth of trees. The effects have been fairly distinct in all cases,—reducing the color with one exception, and apparently increasing size of fruit and tree-growth. In all cases, the color is least on the plots receiving stable manure. In the old orchard, manure shows some advantage over commercial fertilizer in wood growth and in size of apples, with effects reversed in the young orchards. The greater effect of commercial fertilizer in the young orchard is probably connected with the smaller area over which it is distributed, thus giving relatively stronger applications.

The above data are obtained from extensive work through a short period. In Table XI, we have data from the reverse conditions,—one experiment continued over 21 years.

TABLE XI.

Massachusetts Experiment on Apples, 1889-1910.

Treatments and Total Yields per A., to Date.

Plot.	1	2	3	4	5
Annual Treatment.	Manure, 10 Tons.	Wood Ashes, 1 Ton.	Check.	Bone & K Cl 600 & 200	Bone & Low G. Sulfate, 600 & 400
Average Girth, Ratios, -----	38.25 in. 186.7	33.23 in. 118.8	27.98 in. 100	32.27 in. 115.3	37.02 in. 182.3
Yields, lb., Ratios, -----	24,934 632.8	12,841 325.9	8,940 100	14,453 386.8	21,863 554.9
Color and Size,	4	1	5	8	2

These results are similar to those recorded in the preceding tables with the difference in some cases even more distinct. In every respect the treated plots have proved superior to the untreated. Manure leads in yield and growth but falls next to the check in quality. It is closely followed in yield and growth and much surpassed in quality by plot 5, which received ground bone and low grade sulphate of potash. The superiority of 5 over 4, which differs only in the carrier of potash is very interesting. Whether it is due to the magnesia in the sulphate or to a harmful effect of the chlorine accumulating from the muriate, or to a soil difference, cannot yet be stated. It will be recalled that our results of the muriate.

The practical point, however, is that with such differences as these existing, even though unexplained, the safer policy is to apply potash in the sulphate form. The difference in cost is small, and

if so desired it can be readily met by a reduction in the amount of potash applied. This would be justified by our present results, which indicate that the usual recommendations of this material for orchard use may be reduced to advantage.

SUMMARY AND PRACTICAL SUGGESTIONS.

From a general view of the results as a whole, we see that there is more than one way of securing good results in orcharding. In other words, there is more than one way of varying the limiters after they are found. For example, we can conserve moisture either with tillage or mulch, or we may secure apparently the same net results by proper fertilization. This gives opportunity for choice and permits the grower within certain bounds to determine his course on the bases of relative expense and practicability.

In most cases and especially in bearing orchards, this choice will result in tillage, either every year or one year in every two or three. The tillage will be supplemented by leguminous or other proper crops, and will receive additions of plant food when needed. But the relative cost of labor, mulching material, and manures, varies with the locality. And where labor is scarce or costly, or the land too sloping or stony for tillage, the grower need not lose heart. But with a good mulch properly supplemented with plant food, he may grow apples equal to the best,—apples in many cases more satisfactory than those of the man who depends entirely on tillage.

When we come to the application of fertilizers, the best test for their needs is in actual trial or experiment. The appearance of the trees after all other factors are apparently right, may afford some evidence, as may also soil analyses. But the only sure evidence comes from careful trials, remembering that fertilizers can have little if any effect on the current year's crop.

Pending actual results, if it is desired to use fertilizer, our present general advice is to apply one carrying about 30 lb. nitrogen, 60 lb. phosphorus pentoxid (P_2O_5), and about 50 lb. potash (K_2O) per acre. This should be accompanied by green cover crops or alternated with stable manure, ten tons per acre, at least once in three or four years.

The time of application is important. For soluble and transient materials like nitrate of soda, the best time is when the need is greatest, which is probably immediately after the supply of stored food is exhausted, or some time after petal-fall and before the first

ESSENTIAL ELEMENTS OF SUCCESS IN FRUIT GROWING.

MR. ALBERT T. REPP, *President New Jersey State Horticultural Society, Glassboro, N. J.*

Mr President, Ladies and Gentlemen, and Members of the Adams County Horticultural Society: I see that I am on the program for "Essential Elements of Success in Fruit Growing." One of our successes in New Jersey is the fighting of insects of the apple. In a practical way, we may talk on different methods used in different sections. When I attended a meeting last winter I visited a fruit farm where I saw the fruit grower trimming his trees in a way which looked very much to me as if he was ruining his orchard by his hard trimming. Some time ago I received a letter from him stating that he had received as high as six dollars per tree from a four year old orchard. So I think we have to be a little conservative about judging methods from other sections. But insects are the same in one section as in another—you have the same scale, same codling moth, same curculio and lice as we do, and the same methods will kill them. I am aware of the fact that Pennsylvania is a lime and sulphur state, and I feel a little timid about mentioning the material that we use for killing scale, which is crude oil. We start to spray about the middle of February with oil, after heating it to about one hundred degrees with live steam, agitated as it is used, so as to keep the heavier oils and light oils together, using as high a pressure as we can get, and after spraying for the scale, we begin to spray for lice. We will go over the trees with a light spray of oil when the leaves are as small as a mouse's ear, or smaller; the next thing that we spray for is the codling moth and the curculio, following immediately after spraying for the lice. We used four pounds of arsenate of lead to fifty gallons of water. This year we will use five pounds. Except where we had scab on our Winesap last year, we will omit the arsenate of lead and use instead one-half pound of Paris green, three pounds of sulphate of copper with ten pounds of lime to fifty gallons of water. The reason we do not use the arsenate of lead in the Bordeaux mixture is because we use an excess of lime, which would make it too nasty to spray with. After the blossoms

lap back and repeat this about every ten days, until they stop coming from the apple. With all our spraying we find as high as fifty worms to a tree.

I have brought one of these bands to show you how it works (Shows burlap band with codling moth cocoons attached). We place one of these bands around the butt of the tree. We used one last year, and are going to use two next year—one at the bottom of the tree and one at the beginning of the limbs.

Question: At what season of the year do you apply these?

Answer: About the first of July—just as you see them coming out. Each moth lays about 200 eggs for the next year. These bands are put on after spraying, and are changed frequently. This one was taken off day before yesterday.

There are three brothers of us in the John Repp Estate. I have charge of four hundred and fifty acres all set in fruit that consists of pears, apples and grapes, with 14,500 winesap alone,—seven thousand just coming into bearing. Charles F. Repp has charge of the Cold Storage and Ice Plant, with a capacity for storing 10,000 barrels of fruit, and a capacity for making thirty-five tons of ice per day.

“GETTING TOGETHER.”

MR. C. E. BASSETT, *Fennville, Mich., President Fennville Fruit Shippers' Association.*

In the words of the old colored preacher, “Before I begin my talk I want to say something.” I do not presume to come to yon with an idea that I can present any new or startling facts. I have frequently noted that the value of gatherings of this kind lies not so much in the new ideas received as in the inspiration or enthusiasm, which results from an exchange of experiences. To any wide awake man the spirit of enthusiasm is contagious and, noting the successes of a friend or rival, is sufficient to arouse in him the determination to excel in a similar line. Nine-tenths of life's failures are due, not so much to an ignorance of methods, as they are to a want of the proper energy to do as well as we know how. So, if I may be able to add my mite in making this an “inspiration meeting,” I shall feel amply repaid.

The fruit grower, like the grower of any commodity, is chiefly concerned with two factors, viz., the art of production and the art of selling. Both of these factors must be given due attention if the grower is to attain that degree of success which he should. He may know the fundamental principles of fruit growing and be able to put into the fruit package a strictly No. 1 or fancy article. This, however, does not always insure a return to the grower in keeping with the grade and quality of the product. It is true that high class fruit

properly graded and properly packed will often take care of itself and net handsome returns to the grower when placed in the hands of the commission man, or even when placed upon the general market. Unfortunately, however, this cannot always be relied upon, and so we have come to realize that the producer must give serious attention to the art of selling. It is certainly to his advantage that this business end of things be no longer left with speculators who are yearly securing larger returns for their labors than are the growers of the product. It is as much our business to market what we grow as it is to grow it. It is not enough for us as fruit growers to produce fancy fruit; we should see to it that that fruit goes into the hands of the consumer and that the prices paid us are entirely in keeping with those high prices usually paid the commission man or the speculator. That this can be successfully done needs no argument before such an intelligent body of horticultural people as I see assembled here this afternoon. Many of our best fruit growers throughout the country are attending to the business side of their affairs in a business-like way, and as a result of these additional efforts are reaping handsome returns.

The reason why most fruit growers have hitherto given little attention to the selling of their products is because of the fact that their entire energy has been given to the production of the fruit and its preparation for market. Their product is perishable, and where sales cannot be made for spot cash it is often necessary to make consignment to commission firms. Probably no class of business men are more thoroughly condemned or more fully trusted. Millions of dollars worth of produce are sold by them upon honor with scarcely a restraint or check upon their actions except such as may be dictated by policy or their own conscience. It is little wonder then that selfish and dishonest men enter this field of business to the constant annoyance of decent men and that such suspicion as may be engendered by rascality will often attach to the best firms in the same line of business. Good, strong, honest firms may be found in most all cities by inquiry in the proper channels. Let the best be selected for patronage, and then make them your partners.

This is an age of co-operation. Competition has been so sharp and the desire for increased profits is so great that we find nearly every class of business well organized for mutual profit. The world never saw such combinations of capital as have lately been formed, under what we are pleased to call the "trust" system. In some lines of business competition had destroyed profits and a combination was necessary to cheapen the cost of production or increase the selling price of their products, or both.

Let us look at the horticultural situation and see if our present methods are not in need of improvement. As a result of careful in-

union there is strength," has become an axiom, but these abstract propositions are not enough to solve the problem. We want to know *how* to apply the remedy to the disease, so as to get practical results. I know of no better way of showing how co-operation can help us then by telling you of some ways in which it has aided us in the fruit belt of western Allegan county.

One of the first drawbacks that we had to contend with in the Michigan fruit belt was the cost of transportation. The location of our orchards is such that we can patronize either the railroad or the boat lines, but there has been no competition between them. An express company operated over the fruit train for about fourteen years, furnishing very poor service and stubbornly maintaining a six-and-one-half-cent rate on small baskets to Chicago. We had no organization, and the efforts of individuals to get better or cheaper service were of no effect.

The season of 1888 brought such low prices for fruit that it was evident that something must be done, and co-operation was resorted to. The Fennville Fruit Shippers' Association was organized in 1891 and the "Granger System" of shipping fruit was adopted. The success of our association under this plan has been wonderful. We have a local agent of the association who receipts for and loads the fruit into ventilated cars, holding about 2,500 small baskets each, for which he receives \$2.50 per car. A special fast fruit train starts from Fennville at six o'clock every evening, Saturdays excepted, for Chicago. The cars all billed to our Chicago consignee, who does the unloading and attends to the freight, shortages, etc., receiving for this service \$5.00 per car.

As a result of this co-operation, we have been able to secure the general adoption of a more or less standard climax package, which has resulted in a saving in their cost of more than one-half. The freight rate has been lowered from the express rate of six and one-half cents to two and one-half cents, and the boat lines having to meet this competition, every shipper in our fruit belt has been equally benefited by the operation of our association, whichever way he shipped. All shortages have been promptly paid, which is quite a different experience from that we had with the express company. The association has actually reduced the cost of packages and transportation to about one-third of what it was under the old plan. It is impossible to estimate the actual amount of money saved by the work of this association, but some idea can be imagined when I tell you that the very first year the association did business it saved one large grower fully \$1,000. In one year our fruit section shipped 6,000,000 small baskets of peaches, and the saving to the growers that year was over \$200,000.

Not only have we obtained better service at much less cost, but it has been done with a cash profit to the association. This

a single individual has trouble in getting the ear of the railway officials, the representatives of an organization of 400 shippers receive a most respectful and gracious hearing.

So much for what we have been able to do in reducing the cost of transportation. There is another feature I desire to refer to and that is the way in which our growers have co-operated in the manner of packing and selling our fruit. It is generally conceded that the old method of consigning fruit, to be sold on commission, is entirely wrong and our local horticultural society has been working for some time, trying to establish a local fruit market and get outside dealers to come there and buy. Advertising booklets have been sent out, with the result that we have buyers with us all through the season, and their competition has kept prices fairly good. During the past four years, from eighty acres of fruit, I have not consigned to the amount of \$25, but have sold at home at very satisfactory prices.

But there is another form of co-operation which, with us, promises to be of permanent benefit—the central packing house system. We have five of these packing houses in Fennville and although the system is not fully perfected, it has already demonstrated its efficiency in handling and marketing the products of large orchards. Usually six or eight growers combine and erect a packing house beside the railroad. Their fruit is brought direct from the orchards to this central packing house, where it is carefully graded and packed, each grower receiving credit for the number of baskets of each grade. The foreman and packers, having no interest in the fruit, pack top and bottom alike and every basket can thus be guaranteed. Solid cars of one straight grade can thus be purchased and any day during the season, and we find that buyers will pay more for this fruit than where they have to drive around the country and pick up a load, of as many grades as there were packers.

The obstacles in the way of this central packing house plan may be mentioned as: First, what may be termed the natural conservatism of the average grower; second, the lack of confidence in his fellows and of the results to be obtained by association and combination of interest; third, some expense in putting up and equipping a plant; and, fourth, enterprise and confidence in the outcome to carry on the undertaking. A rather high order of ability and good judgment, combined with some experience, is necessary in managing such an undertaking, and the manager must command the confidence of his associates and patrons.

The principal advantage is the application of modern and systematic business methods to the fruit industry. Organization is the basis of modern successful business operations, and only those lines of business that are well organized are successful in a marked degree. The statement is often made that an organization among farmers is sure to fail, that farmers will not hang together, etc., *ad nauseam*. I think that the experiment among our packing houses disproves this statement, and I believe that the tendency among progressive fruit growers is toward such organizations. I believe that these separate packing houses will eventually grow into federation, with a central head, that shall keep in touch with all of the principal markets and keep the units of the federation informed regarding markets and prices,—a fruitgrowers' "trust," if you please.

The packing houses furnish a more reliable and desirable quality of fruit and Chicago prices are obtained for the fruit at the point of shipment, thus effecting a saving of nearly half the expense, as noted above. It is evident that the dealer in Buffalo, who would be willing to pay 75 cents per bushel for a car of peaches in Chicago, of the uncertain and damaged quality that he would get there, would willingly pay the same price for fresh, straight-packed fruit here, as the expense of shipping is no more; and so the grower receives 75 cents at the packing-house for fruit for which the commission man returns the consignor 50 cents. Experience has abundantly proven this self-evident assertion.

I trust that you will pardon me for speaking so at length about what we have done at Fennville, but our successes have opened our eyes to the possibilities of what may be accomplished by a unity of action. If agriculturists could be brought to realize what co-operation might do for them, who could live without paying them tribute? In my experience among growers, I have found among them *parasites* who would oppose co-operation in every form, for no other reason than that the less his neighbors know, the greater his opportunity to profit by their ignorance.

Co-operation is the beacon light of emancipation to the farmer and the only means by which that traditional fear and suspicion, born of wrongs and injustices as far back as Jacob and Esau, can be dispelled. Where co-operation is the watchword, the community is immune from the adventurer, who figures farmers generally as his legitimate prey.

DISCUSSION OF VARIOUS NURSERY METHODS OF PROPAGATION FOR THE BEST ORCHARD RESULTS.

By PROF. W. J. WRIGHT, Assistant in Horticulture, Pennsylvania State College, State College, Pa.

It is unfortunate that there exists among farmers and fruit growers a general feeling of distrust of the nurseryman. It is still more unfortunate that this feeling is not always without foundation. In fact so general has been the dissatisfaction among buyers of nursery stock that the "tree agent" and the nurseryman have often become the butt of ridicule at horticultural meetings and in the local

responsibility of the agent. Well established firms having a reputation to maintain, seldom distribute misnamed varieties. The business system of a well regulated nursery is such that mistakes are well nigh impossible and it would be poor business policy, to say the least, for a well established firm with a large investment to wilfully send out misnamed trees. On the other hand, there are constantly springing up throughout the country so called nursery firms who are in reality only dealers, and who buy every tree they sell. Such firms have but little invested and do not feel so keenly the need of an unsullied reputation, nor can they be so well assured of the quality of the stock they sell or its trueness to name as can those who grow their own stock or have it grown on contract. The guarantee that stock is true to name, backed up only by the promise to replace trees not found so, is of little value to the buyer who must wait until they come into bearing to make sure.

The danger of getting diseased trees is now reduced to the minimum by an effective nursery inspection. It forms, however, a strong basis of complaint by buyers against nurserymen. In most cases diseases are probably introduced in some other way. Though there is no doubt some danger, it is one of the lesser of the tree buyer's troubles.

Another cause of complaint is that trees received from the nursery are improperly headed. Nurserymen it is true have been slow to accept the idea of low headed trees for very good business reasons on their part. Nursery stock is planted close. The tendency is therefore for trees to head high. Low headed trees require more room, thus fewer trees per acre. Most nurserymen can supply low headed trees if desired. The trouble too often is that the buyer neglects to specify his preference in the order. Yearling trees are always to be had and present the advantage of allowing the buyer to form the head as he chooses.

The substitution of varieties is a practice indulged in even with some of our most reliable nursery firms and is the cause of much dissatisfaction. It is not to be expected that a firm will carry every variety of fruit grown, but they should carry every variety they catalogue. If the order is placed early and no notice is sent that the order cannot be filled to the letter, the buyer supposes that no varieties will be substituted. If, when the order is received, it is found that substitutions have been made the firm should be wired at once and a settlement demanded. In case it is too late or it is otherwise impossible to obtain the desired variety that season, damages could probably be collected.

On the other hand the buyer may delay his order until late in the planting season and then demand the trees to be sent at once. Under

(4) State specifically just what you want both as to the varieties, and style and class of stock. Don't leave any room for supposition.

(5) Give explicit shipping directions, and state just when you wish stock delivered.

(6) Remember that the purchase price of trees is a small part of the orchard cost. A few dollars extra spent for trees, if it will purchase just what you want, will be well spent.

(7) Make it your business to see that trees are not delayed in transit.

(8) Carry out your part of the contract by seeing that the trees are well cared for on arrival and that they are properly planted.

That there is dissatisfaction with ordinary grown nursery stock cannot be denied and many growers are casting about for a means of overcoming these troubles. Then, too, there is a growing desire among orchardists for so-called pedigree stock—stock of known parentage. Many have tried the experiment of having their stock grown to order by experienced nurserymen. Thus grown, it costs slightly more than common stock, but has not always given satisfaction. In fact there is a growing tendency among orchardists to grow their own trees.

It is not the policy of the writer to advocate this plan in all cases. The operations of plant propagation are simple in the extreme, though not all who attempt it on a commercial scale are successful. In fact the determining factor of a successful grower of nursery stock is a knowledge of plants and their needs. Almost any orchardist who is capable of caring for an orchard and bringing it into bearing should possess that knowledge. Of the two accomplishments, the latter probably requires the greater skill, but the orchardist who attempts to grow his own trees should not be surprised if each specimen which subscribes to his ideal costs him considerably more than would ordinary stock bought from a nursery. The cost price of trees, however, as has already been pointed out, is but a small part of the orchard cost, and if satisfaction is secured by this means it may be overlooked.

The writer supposes that those who may be interested in growing their own stock are familiar with the processes of root-grafting and budding and the methods of securing seedling stocks. If not, they are referred to the Nursery Book by Bailey, probably the best book on the subject, or to Plant Propagation by Fuller, or to various Experiment Station and Farmer's Bulletins on the subject. These are, however, a few points which have been discussed pro and con in horticultural papers for the past few years which might be briefly touched upon at this time.

One of the points is the relative merits of budded, whole root grafted, and piece root grafted apples. Briefly the advantages claimed for each are as follows:

year quicker. Those favoring the use of whole roots claim to secure a stronger tree from the fact that it receives more nourishment than the one grown from a piece root graft. Those favoring the piece root system contend that the only object of the root is to start the scion growing and keep it alive until it can send out roots for itself and that the real object should be to induce the scion to send out roots by giving it only a small stock in order that the tree may essentially be on its own roots. The fact that either system produces good trees is sufficient argument that all are good.

For extremely cold climates where roots are liable to winter injury it is probably the best plan to have trees on their own roots instead of some seedling stock root whose hardiness is not known. In this case the piece root system seems to be the best adapted.

Another topic of considerable importance is the relative hardiness of seedling stocks grown from seeds of hardy varieties. There are those who claim that stocks grown from Northern Spy seeds, for example, are resistant to attacks of woolly aphid. This point has not been distinctly proven. From the fact, however, that the seedling rarely reproduces the qualities of the parent variety to any marked extent, so far as fruit and manner of growth is concerned, it can hardly be expected that it will retain this important characteristic of hardiness with any greater degree of certainty. When relatively small numbers of stocks are to be raised, however, it might pay to grow them from seeds of such hardy varieties as Northern Spy, Ben Davis, etc. (Such stocks can sometimes be bought.)

Pedigreed trees, or trees of known parentage, have already been referred to. The idea that stock propagated from trees which are especially fruitful of which bear fruit of exceptional quality will reproduce these desirable characteristics has been gaining much popularity in the past few years, though it has been practiced unconsciously for centuries in the selection of seeds. In graftage, however, sex does not count, which makes of it a different problem. That this characteristic may or may not be transmitted depends probably upon many circumstances, two important ones of which are: (1) Is this particular tree notably fruitful because it is especially favored by external conditions, such as food, moisture, etc., or, (2) Is this tendency to fruitfulness a reproduction of a characteristic of its parent? If the former, we should expect no transference of the characteristic. If the latter, it is reasonable to expect that the characteristic will be transmitted. In the vegetable kingdom the bud and not the plant is the unit. Every bud is different from every other bud, and if detached is capable of reproducing a similar plant if given the proper environment. Every tree of any one variety is the asexual offspring of a single bud or tree. Occasionally a certain bud or branch on a tree or plant is entirely different from its fellows. The tree sports as the horticulturists say. Many new varieties arise in this way. The nectarine is simply a smooth skinned peach, the results of a sporting bud. The King grape is a bud sport of the Concord. Both are propagated by budding or by cuttings, and reproduce their kind. If then, the more fruitful tree is the result of a bud variation, we may expect it to transmit that characteristic to its asexual posterity. If its fruitfulness is due to external influences, such as food, moisture etc., then it can not be expected to transmit these characteristics to its asexual offspring. In other words, we

must know the history of the parent before we can determine whether or not it will transmit such a characteristic as extraordinary fruitfulness to nursery stock propagated from it.

Such questions, the would-be grower of fruit trees for his own use, must take into consideration and decide for himself until more definite proofs are at hand.

INTER-CROPPING OF YOUNG ORCHARDS WITH SPECIAL REFERENCE TO ADAMS COUNTY.

PROF. R. L. WATTS, *Department of Horticulture, State College, Pa.*

The development of young orchards is a business proposition. There is an aesthetic side to the enterprise, but primarily orchards are planted for profit and not for pleasure.

The paramount question in the minds of most prospective fruit growers is, What investment is required to bring an orchard into profitable bearing? Hundreds of people do not plant orchards because of the financial burden in caring for them before they begin to yield returns. On the other hand, a host of men in this State have planted trees with the full intention of giving them the proper care, but have failed largely because the necessary funds were lacking. I am personally acquainted with young men who would like to engage in fruit culture, but the expenditures demanded before there is any return is a serious barrier. The capitalist is just as much interested in this question. Three men from a Pennsylvania city visited State College recently and said they had \$25,000 to invest in the development of a great commercial orchard, but they much preferred a plan and policy which would not call for the spending of the entire sum.

Planters should bear in mind that every year added to the age of a well-cared-for orchard of approved varieties enhances its value. There is an increasing number of men who are willing to pay a liberal price for young orchards that have not reached a bearing age, and with this knowledge, growers should not hesitate to plant trees and follow approved methods in their care. Any plan, however, which will reduce the cash outlay in growing a young orchard will be welcome by all classes of fruit growers.

THE AIM.

In the development of young orchards, the aim should be to grow the very best trees at a minimum cost. Any plan of culture which does not have this high purpose should be condemned. The growing of crops between the trees is a secondary matter and should not at any time interfere with such treatment as will result in perfectly healthy and properly grown trees.

Inter-cropping in orchards has not been popular with the rank and file of orchardists, mainly for three reasons. First, it has been claimed that the trees need all the plant food naturally furnished by

the soil and any additional amount that the grower might be able to supply, and that the cultivation of companion crops necessarily robs the trees. This is a weak argument and many instances might be cited where ample food has been supplied for both trees and companion crops, which of course is absolutely essential to success, both from the standpoint of the orchard and of the inter-tillage crops. Second, it has been claimed that tillage is interfered with when crops are grown between the trees. This may or may not be true. It depends upon the character of the crop selected and also upon the method and frequency of cultivation. By choosing the right crop and by giving it the right kind of tillage the trees will not suffer from lack of cultivation. Third, the most justifiable reason for not inter-cropping is that it places additional irons in the fire, some of which are likely to be burned. To engage in market gardening or potato culture on a large scale in connection with orcharding requires considerable executive ability. Not all men can succeed in handling garden crops on a large scale and at the same time give the trees proper attention.

INTER-CROPPING BECOMING MORE POPULAR.

In recent years, however, inter-cropping is becoming more popular. It is not difficult to cite instances where the plan has been worked out with entire success. One of the best examples is that of the well known horticulturist, Mr. H. C. Snavely, Lebanon, Pa. Mr. Snavely was formerly chairman of the General Fruit Committee of the Pennsylvania Horticultural Society, and he is recognized as one of the most intelligent and successful orchardists in the state. In 1907 Mr. Snavely planted four rows of potatoes thirty-four inches apart, using the variety known as Carman No. 3, between the peach trees which were set at standard distances. The land previous to the setting of trees was plowed very deep and thoroughly harrowed. No fertilizer was used for the trees at the time of planting, but 1,000 pounds of 2-8-7 mixture was applied in drills for the potatoes. Thorough tillage was given during the season. The potatoes were planted April 5th. From twelve acres 2,000 bushels of potatoes were harvested and the trees made a most satisfactory growth. The trees for this orchard were the largest that could be secured, some measuring eight feet in height at the time of planting. In 1908 potatoes were again planted, but on account of severe drouth, only 860 bushels were harvested. The growth of the peach trees the second season was also satisfactory. I have not heard directly from Mr. Snavely this year, but I understand that he harvested a fine crop of peaches. Mr. Snavely has told me repeatedly that he never saw a finer young orchard.

the price is right and to plant all or part of it with fruit trees. Peaches, apples, pears, plums and cherries are grown extensively on the Robert's farm, and inter-tillage crops are used in all the plantations. In a number of instances it has been possible to pay for the places from the profits of two seasons. Expenses of the young orchards as well as of the entire farm are more than paid from the outset, and it should also be noted that the farms become more valuable because of the starting of young orchards and of the improvement in soil fertility. Many other growers within easy reach of Philadelphia markets have been practicing companion cropping with success. The most common practice on the Roberts' farms is to plant peas as early as possible in the spring, following with such crops as tomatoes, sweet corn, muskmelons, cucumbers, watermelons, potatoes and other crops that may be sold to advantage in Philadelphia. Most of the farms are about eleven miles from the city and nearly all produce is marketed by wagon.

PRINCIPLES INVOLVED.

In deciding as to the kind of crop which is best adapted to any particular location, the following points should be considered:

(1) The equipment and capital required. The growing of such crops as peas, sweet corn and potatoes would require a very much smaller outlay for equipment than early cabbage and early tomatoes which must be started under glass. Practically all farms have the tools necessary for the growing of potatoes, although if undertaken on a large scale it would be necessary to secure planters and harvesters, while one could not expect to grow early cabbage and early tomatoes on a large scale without extensive areas devoted to hotbeds, cold frames and perhaps greenhouses.

(2) The natural bent of inclination of the grower should be taken into account. Many people who are very fond of fruit culture would not make a success in growing vegetables because these crops do not appeal to them. This is a most important factor and should not be ignored by the individual or the community.

(3) Inter-cropping requires more labor than when no crops are grown between the trees. This may or may not be a serious factor. If the grower possesses sufficient skill to make a success in the growing of vegetables or other companion crops he can well afford to pay for labor in competition with other classes of producers.

(4) A most important factor to be carefully considered is the question of markets and marketing. On account of easy access to a large market, the growers of Moorestown possess special advantages over persons operating remote from large centers of population. Although these men are within easy driving distances of Philadelphia, much time of the men and horses is required to cart the produce to market. If a good shipping trade is developed it possesses special advantage in requiring very little time for the delivery of vegetables at the railroad siding.

(5) Some crops which might be grown between fruit trees require more skillful management than others. This factor is well worth the consideration of the orchardist. His time and thought are needed in caring for the trees and if inter-tillage crops can be selected which are simple to cultivate, it will be a decided advantage.

(6) When the growers of a given community desire to engage in the growing or inter-crops, it would be a great advantage to decide upon a few short crops that best meet the requirements of the locality. To make such an enterprise a success, those crops should be selected which require the least skill unless there is assurance that more difficult crops can be grown successfully.

(7) Crops should be grown for which there is a large demand. Potatoes are especially desirable because this vegetable is consumed in very large quantities. From the standpoint of demand, cabbage probably ranks second, and tomatoes third.

(8) It is an advantage to select crops that have the fewest enemies to combat and which may be controlled without great difficulty. Looking at the matter from this standpoint, the tomato is one of our best crops, especially if rotation is practiced.

(9) Other things being equal, it is important to select crops which will inter the least with spraying. Crops with erect habit of growth will permit the use of spray machinery, while those of a straggling nature would not allow the use of carts or wagons without damage to the companion crop.

(10) The location is a most important factor in deciding the crops which should be grown between the trees. It is especially important to select those which are adapted to your soil type. Some crops, as cabbage, have a much wider adaption than others. The quality of the companion crop will depend largely upon the character of the soil. A large crop of potatoes might be grown successfully on limestone soils, but they lack quality as compared with tubers grown on sandstone. Early tomatoes are smoother and more regular when grown on the higher soils. The question of exposure should be considered with reference to this problem. In orchards having trees on sunny slopes, the growing of early crops as peas, cabbage and tomatoes might well be considered, while it would probably be futile for fruit growers on northern slopes to attempt the culture of these crops. The steepness of the land must also be considered. It is impracticable to grow on steep hillsides crops requiring frequent tillage.

(14) It is desirable to select crops which have the same fertilizer and tillage requirements as the trees under culture. Cabbage, for example, is not a desirable crop to grow in peach orchards, because it requires more nitrogen than is required by peach trees. On the other hand, there could be little objection to the growing of this crop in apple orchards, provided the soil is well filled with humus. The moisture requirements for certain inter-tillage crops is perhaps the most serious objection to their use. Cabbage, for example, contains ninety-eight and a half pounds of water, and unless the water absorbing and holding power of the soil is great the trees may suffer on account of lack of moisture. This difficulty, however can be overcome by supplying humus in sufficient quantity and

and sold before the proper time to sow cover crops are, other points being equal, the most desirable. Peas, early cabbage and early potatoes meet this requirement.

(14) Companion crops should be selected if possible which permit thorough tillage and as late in the season as may be best for the welfare of the trees. This matter can be controlled to a considerable extent by allowing a liberal amount of space between the rows.

(15) The net profits from companion cropping should be the main factor in deciding as to what crops should be grown provided the cultivation of such crops is entirely favorable to the growth of the trees. The skillful management of crops which require starting under glass, as early cabbage and early tomatoes would certainly return larger profits per acre than potatoes although the growing and harvesting of the crops would require much more attention.

DIRECTIONS FOR GROWING COMPANION CROPS.

Sweet Corn, and especially the early varieties may be grown with entire success in young orchards without detriment to the trees. By planting the early varieties in thoroughly drained soils which have been well enriched by the plowing down of clover sods and the application of manure along with high grade fertilizer the crop would be harvested in ample time to start cover crops. Some of the best varieties for this purpose are Crosby, White Cob Corry, Premo, Fordhook First and Golden Bantam. Later varieties may be grown with entire success, but the crop is harvested rather late for sowing cover crops.

Small Fruits may be used as companion crops in orchards, but are undesirable because they require tillage later in the season than is favorable to starting cover crops. I see no reason, however, why the bush fruits could not be grown in the orchards of Adams county, using each year a legume as cow peas which would be killed by frost and which add materially to the supply of vegetable matter. Soy beans are better adapted to clay soils. They made a much larger growth at State College in Hagerstown clay loam than cow peas. None of the small fruits, however, are generally regarded as good inter-tillage crops for the orchard.

Peas meet the requirements so far as the trees are concerned, better than any other vegetable. They add nitrogen and vegetable matter to the soil when the vines are plowed down and do not draw heavily upon the supply of mineral elements. The earliest varieties should be used and planted just as soon as the ground can be prepared. The largest yields are procured by the free use of seed and thorough cultivation.

Tomatoes, when the bulk of the crop is off before the middle of August or the first of September, is a desirable crop. It is important to use an early variety such as Earliana and grow strong, stocky plants, carrying a cluster or two of flowers, which are set in the field as early in the season as the locality will permit. This is important because yields are larger from early set plants and the profits are certainly larger from the earliest crop. If necessary, nitrate of soda may be used soon after planting to stimulate growth and it may also be an advantage to the trees.

Early Cabbage may be grown without detriment to the trees, provided the crop is manured and fertilized as liberally as possible, to make it a success as well as to furnish the trees with needed plant food. The best variety is Jersey Wakefield, securing seed from a house which has an improved strain. If a larger variety is wanted, use Charleston Wakefield. In Adams county the seed should be sown not later than the middle of January, transplanting to the cold frames when the plants are four or five weeks old, and setting the well hardened plants in the field as soon as the weather will permit. The profits from this crop are large when it is properly handled.

Early Potatoes are exceedingly desirable for this purpose. All points considered, we probably have no crop which is so valuable for companion cropping. The advantages are the small cost of equipment for growing the crop; soil and fertilizer requirements are very much the same as for most fruits; it must have the same amount and the same kind of tillage as is favorable to tree growth; there is a large demand for this product; it is a simple crop to grow as well as to harvest and market; and the crop matures in ample time to follow with crimson clover or other hardy legume. To make the crop a full success, great care should be exercised in preparing the soil and firm seed should be planted as early as possible in the spring. There should be no delay in harvesting the crop after it has reached marketable size.

SOME EXPERIMENTS WITH COMMERCIAL LIME SULPHUR AS A SPRAY FOR FRUIT DISEASES.

By H. H. WHETZEL, *Professor of Plant Pathology, New York State College of Agriculture.*

During the winter of 1908-'09 there was much demand from fruit growers for recommendations regarding the use of lime-sulphur solutions as a summer spray. Plant Pathologists generally, particularly here in the East, advised growers to go slowly. If they desired to try these solutions experimentally on a few trees, good and well; but all were advised against the general use of this on the foliage of their trees, until pathologists had time to determine whether this could be done with safety and efficiency. The experiments of Cordely in Oregon using the home boiled concentrated mixture, and the work of Scott of the U. S. Department of Agriculture with his self boiled lime-sulphur, had been reported in the Horticultural press and our Eastern growers wanted to know why it wouldn't work here. This demand for information on the subject was the more pressing for the reason that many growers had experienced heavy losses from burning or russetting of the fruit by the Bordeaux. Naturally they were interested in a substitute that appeared to be equally effective and at the same time free from the faults that condemned the Bordeaux.

In order to get some data on the value of lime-sulphur as a substitute for Bordeaux when used under our conditions in the State of New York, we undertook a series of experiments in an orchard

near Ithaca, in the spring of this year (1909). Mr. Wallace, a Fellow in the Department of Plant Pathology, had charge of this work and to him belongs all the credit of the remarkable progress we have made on this problem this season. What I shall here report is chiefly the results of his work.

The work was condemned in two orchards containing several varieties of apples, trees about 15 years old, with peach trees as fillers. Work on three diseases only were undertaken, namely peach leaf curl, apple scab, and brown rot of peaches. A field laboratory was established at Mr. Frear's place, in whose orchards the work was to be done. Commercial lime-sulphur (Niagara Brand, heavy grade) was used as this was what Mr. Frear had already purchased for his winter spraying. Mr. Frear furnished all materials, gasoline power sprayer, etc., and Mr. Wallace assisted in all the application made. The work was very thoroughly done.

RESULTS ON THE PEACH LEAF CURL.

In these experiments comparisons were made between Bordeaux 3-3-50 and different dilutions of the commercial lime-sulphur. On account of heavy winds that blew constantly it was impossible to spray the trees from but one direction. However as thorough a job as possible under the circumstances, was done. The applications were all made before the buds had swollen to any appreciable extent. Unsprayed check trees were left in every series of experiments. The results showed that the lime-sulphur at any dilution from 1 to 9 to 1 to 20 was more effective than the Bordeaux. The curled leaves on the unsprayed trees averaged from about 35 to 60 per cent, while on those sprayed with lime sulphur they averaged from 1 to 6 per cent. only. On the trees sprayed with the Bordeaux an average of about 8 per cent. of the leaves showed curl. More copper in the Bordeaux might have been more effective. These results are not especially new or striking, as it has long been known that lime sulphur as applied for scale will also effectively control the curl. They serve, however, to again confirm the results of earlier investigators and to demonstrate to the grower the value of lime sulphur for the control of this disease. This is particularly important, as most growers are now compelled to spray for the scale and any solution that will answer both purposes at the same time means a great saving in time and money. Reports from a large number of peach growers all over the state, last spring, indicate that any of the brands of commercial lime-sulphur or the home boiled mixtures used as for scale will successfully prevent the leaf curl.

RESULTS ON APPLE SCAB.

The trees selected for these experiments were Rhode Island Greenings. The lime-sulphur was used at a dilution of 1-30. The Bordeaux was made to the formula 3-4-50. In each case arsenate of lead was used at the rate of three pounds to 50 gallons of the mixture. Six trees were left unsprayed as checks; six were sprayed with the Bordeaux and arsenate of lead; five were sprayed with the lime-sulphur and arsenate of lead. The two mixtures were applied in each case on the same day, with the same pressure (about 125 pounds) and

with equal thoroughness. Some of the trees were sprayed once, just before the blossoms opened. Some were sprayed twice, just before the blossoms opened, and again just after they had fallen. Some were sprayed but once, just after the blossoms had fallen. The results showed that in this orchard this season, the one spraying just after the blossoms fell was the all important one. The tree sprayed only just before the blossoms opened showed nearly as much scab as the checks. This does not indicate, however, that this spraying just before the blossoms open may not often be very necessary. The apples on the table there indicate very well the average run of the fruit on the checks, the Bordeaux sprayed and the lime-sulphur sprayed trees. Careful counts of the apples on all the trees in the experiment showed at picking time that 42 per cent. of the apples on the check trees were scabbed, on the Bordeaux trees this was reduced to 3 per cent., and on the lime-sulphur trees to 3.6 per cent. The lime-sulphur was practically as effective in preventing the scab as was the Bordeaux. However, 82 per cent. of the apples on the trees sprayed with Bordeaux were russeted, i. e., injured by the mixture, and to so severe an extent as to much reduce their market value. The apples sprayed with the lime-sulphur showed less than 4 per cent. of russetting of any kind, in striking contrast not only to the Bordeaux injured fruit, but also to the apples from the check trees, which showed 29 per cent. of russetting, due perhaps to certain weather conditions. Why the lime-sulphur sprayed fruit should have been so free from this natural russetting is not clear. No injury of any kind either to fruit or foliage resulted from the applications of the lime-sulphur at the dilution of 1 to 30. The experiments showed that no addition of arsenate of lead to the lime-sulphur not only did not cause injury to the foliage, but was so effective in controlling codling moth as when used with the Bordeaux. The check trees showed 25 per cent. wormy apples, while those sprayed with lime-sulphur and arsenate of lead showed but 1.3 per cent. as compared with 3.3 per cent. on Bordeaux sprayed trees.

Both Cordley and Scott report good results with commercial lime-sulphur for apple scab this past season. Cordley used the Niagara Brand, and Scott used three brands in his work,—the Grasselli, Thomsen Chemical Co., and Rex. Scott used arsenate of lead with the lime-sulphur with safety, but had burning of the foliage where Paris green was used with the lime-sulphur. Scott's self boiled lime-sulphur also gave excellent results for apple scab.

RESULTS ON BROWN ROT OF PEACHES.

~~The results with the lime-sulphur for brown rot have not yet been~~

We are not recommending the general substitution of lime-sulphur in place of the Bordeaux. We give you the results of one season's work. If you use the lime-sulphur on your trees this coming summer it is with the risks involved in using a solution not yet thoroughly tested out, and whose peculiarities under different weather conditions is yet to be determined. That the lime-sulphur has powerful fungicidal properties is certain. That it will not injure apples (when properly diluted) under conditions that produces russetting by the Bordeaux is shown by Mr. Wallace's experiments. That it is very probably the coming spray is not to be disputed in the light of the favorable reports from experiments in the different fruit sections of the United States this season.

PRACTICAL DEMONSTRATION IN THE BOXING OF APPLES.

By C. C. VINCENT, Assistant Horticulturist, Oregon Agricultural College and Experiment Station, Corvallis, Oregon.

The box apple trade has been given more attention in the great distributing territory, east of the Rocky Mountains, this year, than ever before. For several years commission men in all the large cities pursued an attitude of indifference in regard to the bushel boxes, which are so much in evidence in the Pacific Northwest. But so much fruit has appeared in the eastern markets in boxes, that eastern dealers are obliged to recognize it.

Mr. E. P. Loomis, a prominent dealer in New York City, says: "The tendency of our association is too much an association of barreled apples." "I believe packing apples in boxes is an advance in the industry." I honestly believe that if the boxing of fruit was resorted to, it would do away with the fraud and deception that is practiced with barreled fruit. It would necessitate the handling of number 2 apples as number 2's. The time is not far distant when many of the most progressive growers in the East will market their fancy fruit in boxes.

The recent New England fruit show, held in Boston, has been a step in the right direction. It has demonstrated the fact that eastern fruit when placed in boxes, compares very favorably with the western boxed fruit.

The sales indicate a growing demand for boxed fruit. While on the demonstration fruit train, which ran through the fruit growing sections of New York, a commercial orchardist stated to me that he had received \$2 per box for his Dutchess apples this season. A commercial grower in the Hudson Valley sold some fancy apples for \$3 per box (f. o. b.), local railway station. What these men have done, others can do, if proper care and attention is given the selection of the fruit.

Those who are unfamiliar with western methods wonder why it is that the growers are able to receive such large prices for their fruit each year. It is a well known fact that they have been and



Fig. 1.—Packing Table in General Use.

are receiving as much per bushel as the eastern growers are receiving per barrel—3 bushels. This fact is especially true in the London and Liverpool markets.

The reasons are obvious. The English buyers know that every apple is uniform in size and shape. They can depend upon the western boxed fruit as to quality. Thus they can afford to handle this fruit at a much narrower margin of profit than apples in barrels.

What has been done in the West can be done here in the East. Right here in this locality, if the progressive growers will band together. This organization is a step in the right direction.

From what observation I have made in New York and also in Pennsylvania, I find that you *can* grow the fruit. Your exhibition has demonstrated that fact. The color of your fruit is excellent. The next problem is the placing of this fruit on the market in the most profitable way. The solution to this question, I believe, will be the adoption of the bushel box.

This morning I will give a practical demonstration in the boxing of fruit, as is practical on the Pacific Coast. Such points as picking and grading will also be briefly discussed.

WHEN TO PICK.

The time to pick the Spitzenburg, or any red apple is usually ascertained by its color. Many growers make the mistake in picking their fruit to green. Fruit lacking in color is usually a drug on the market. With flesh colored apples, like the Newton, etc., the time of picking is regulated by the coloring of the seeds. In general though, any variety is ready to be picked when the stem separates readily from the spur. The breaking off of the spurs should never be tolerated.

ORCHARD BOXES.

Just before the harvest begins the orchard boxes are scattered along the rows. This avoids unnecessary delay in the operations

MEMBER. What is the shape of those orchard boxes?

ANSWER. Similar to the box the fruit is packed in. They hold about a bushel, and are made of a little heavier material than the packing box. Cleats are placed on the ends, so that the boxes can be piled one upon the other. I do not advocate the use of the packing box for orchard purposes; new clean boxes are preferable for the marketing of the fruit. Put a dirty box, filled with apples on the market, and notice the effect. The crew of men who are under an orchard foremen are supplied with the necessary picking receptacles, ladders, etc., and then the work begins.

MEMBER. What do you pick the apples into?

ANSWER. Many of the grocers use galvanized iron pails. They are of such a size (10 in. x 10 in.) that they can be lowered into the box thus eliminating the bruising of the fruit to a very great extent.

MEMBER. How about a bag?

ANSWER. Personally, I am not in favor of the bag; for in climbing up and down the ladder, and in stooping over, the fruit is very likely to get more or less bruised.

CHESTER TYSON. It is customary here to use the half-bushel drop handle basket.

MEMBER. Is the pail around?

ANSWER. Yes.

As soon as the orchard boxes are filled with fruit, they are taken immediately to the packing house. The fruit is never allowed to remain exposed to the sun's rays for any length of time.

PACKING HOUSES.

These vary in size and shape, according to the whims of the orchardist. In some instances I have known men to use large tents for this purpose. In the construction of packing houses there are a few points well worth mentioning: One requisite is light; by all means have plenty of windows in your building. Another is plenty of room. Build a large, roomy house.

GRADING.

The apples, on their arrival at the packing house, are placed at the ends or in the center of the building. A crew of men begin immediately to sort the apples. I have here a sizing board (Shows board about 6 inches wide and 2 feet long, with a row of holes through the center, varying in diameter from $2\frac{1}{8}$ inches to $3\frac{1}{8}$ inches in regular sequence), which represents the different sized apples that are put in boxes. This board (See Figure 10) is placed up in a convenient place, before the sorters. As soon as the grader has trained his eye, and this it will not take him long to do, he will be able to discard the grading board for the most part, and can tell at a glance if a certain apple is going to fit in a certain pack. If in doubt, he holds the apple up to the hole, but never drops it through. Some men, the grower finds, soon adapt themselves to this method and become very proficient graders. But, just as you have found in barreling, some men will never learn how.

PACKING TABLE.

The packing table, which stands before you (See Figure 1), represents a style of table that is used quite extensively throughout the West. The table is about three feet high, three feet wide, and three feet long. The uprights are made of 2 inch x 4 inch material; sides, 1 inch x 6 inch. The legs are beveled off so as to leave no sharp edges to bruise the fruit. The top is covered with canvas,, which is allowed to sag or hang rather loosely. To serve as a double protection to the



Fig. 2.—Celebrated Diagonal Pack.



**Fig. 3.—Method of Starting 3½ Tier
Diagonal Pack.**

DETAILS OF PACKING.

Uniform sized apples are brought to the packing table. The packer now begins his first operation, i. e., the lining of the sides of the box with lining paper. This is nothing more or less than common white wrapping paper, which is just a trifle smaller than the length of the box, and about 26 inches in width. The ends are very seldom lined. The next step is to put in the layering paper. A sheet of paper is placed between each layer of apples, and also on the bottom of the box and on the top before the lid is nailed on. If the California Special Box is used this paper would be $10\frac{1}{2}$ in. x $19\frac{1}{2}$ in. in size. It serves a purpose, as it has a tendency to hold the apples more firmly in place.

The hood is now hooked over the side of the box to hold the paper. The wrapping paper varies according to the size of the apple. For three tier and three and one-half tier apples, 10 in. x 10 in. paper is large enough. Smaller sized apples will wrap up very nicely in 8 in. x 10 in. paper.

A monogram is stamped in the center of each paper. This usually contains the grower's name. The paper is prepared by a certain process; one side is smooth and the other side is left a little rough. This rough side is placed next to the apple.

WRAPPING THE APPLE.

Every packer has his own way of wrapping an apple. I pick up the paper with my left hand, thus, with the corners diagonal, and with my right place the apple in the corner, bringing the outer edge of the paper over the apple, then turning it, thus bringing the smooth surface up and the bunch on the bottom. This serves as a cushion. The apple is now placed in the bottom of the box. Repeat the performance until the layer is finished. Then place in the layering paper. Continue the operation until the box is filled. Every apple in the box is wrapped. To aid the packer in the picking up of the paper, a rubber band is placed over the thumb or fore-finger. An expert can put up from 50 to 100 boxes per day. His ability of course will vary with his practice and training in that line.

STYLES OF PACKS.

At the present time there are two styles of packs, known as the square or straight or diagonal pack. In the square pack the apples are placed one upon the other. In the diagonal pack (See Fig. 2), there is less danger of the apples bruising in transit, as no one apple rests upon another, but fits in between the four apples below. Undoubtedly before many seasons pass, the diagonal pack will be the one most largely used. If only the two sized boxes were used, all apples could be packed diagonally. For instance, all the apples that would pack square in the California box, could be packed diagonally in the Standard box. The 3 tier, 4 tier, and 5 tier apples will pack up in the square pack. The $3\frac{1}{2}$ tier, $4\frac{1}{2}$ tier, can be placed in the diagonal pack.

The classification of the apples contained in each box, as is designated by the tin labeling, is as follows:

- 3 Tier Apples in the Standard box, 45 to the box.
- 3 Tier Apples in the Special box, 54, 63.

- 3½ Tier Apples in the Standard box, 64, 72, 80, 88.
- 3½ Tier Apples in the Special box, 96, 104, 112, 120.
- 4 Tier Apples in the Standard box, 96, 104, 112, 120.
- 4 Tier Apples in the Special box, 128, 144.
- 4½ Tier Apples in the Standard box, 150, 163, 175.
- 4½ Tier Apples in the Special box, 185, 200.
- 5 Tier Apples in the Special box, 200, 225.

Unless the apples have been properly graded beforehand, no such system of classification can be obtained. Probably the best place for the 5 Tier Apples, is at the evaporator or cider factory.

MR. BASSETT: In the diagonal pack, are you not selling a lot of empty spaces, instead of apples?

ANSWER: No. If the apples are properly graded, the spaces are confined to each end of the box.

STARTING THE PACKS.

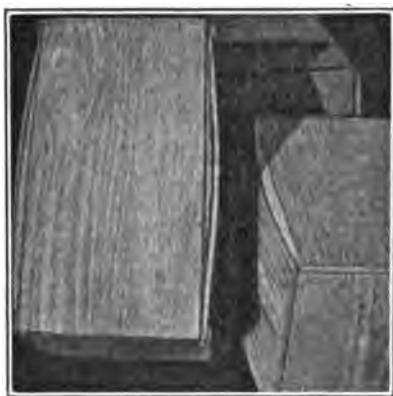
Very little trouble will be experienced in starting the square pack, i. e., if the apples have been properly graded. With the 3 Tier Apple, which is 3½ inches in diameter, it requires 3 apples to fill up the space across the bottom of the box, or in other words there will be 3 rows in width and 3 layers in depth. The 4 Tier Apples require 4 rows in width and 4 layers in depth.

The diagonal 3½ Tier pack (See Fig. 3) is started differently. In this style one gets 3½ rows in width and 4 layers in depth. The first apple is placed in the lower left hand corner of the box, another apple is placed in the center. The following two apples are pressed firmly in the places which are left. This is sometimes called the 2-2 pack.

To start the 4½ Tier pack, place the first apple in the lower left hand corner of the box, another in the lower right hand corner, and another in the center. Two apples are then pushed down, as far as possible in the spaces that are left vacant. The 4½ Tier pack is also known as the 3-2 pack.

THE BULGE.

Inexperienced packers will have some little difficulty in getting the proper bulge to the box. Practice, however, will obviate this. When the fruit is packed, the apples at both ends should come up flush with the top. In the center they should extend a little higher. (See Fig. 4). There is more or less of a graduation between one sized apple and another. For instance between the 3 Tier and 3½ Tier. To obtain the proper bulge, which should be from 1 to 1½ inches, the packer selects apples that are a trifle smaller for the ends, working those that are a trifle larger to the center. In case the apples are of the same size and are being packed on the cheek, in order to obtain the proper bulge, the end apples are turned with the stem ends up. Every box of fruit should have a swell (See Fig. 5). As soon as the box has been filled it is taken to the nailing press (See Fig. 6) and the cover placed on.



**Fig. 5.—Side View of Boxes After
Nailing, Showing Proper Bulge in
Top and Bottom.**



LITHOGRAPHS.

On every box is placed a neat, attractive lithograph. This adds very much to the appearance of the box, and aids materially in selling the fruit. A cheap, gaudy label detracts rather than adds to the appearance. A lithograph should contain the grower's name, the name of the locality, and also the name of the state where the fruit is grown. For instance, "Bendersville, Pa." Let "Pennsylvania" stand out in bold relief. If this is done and the box contains fancy fruit, the grower will soon establish a reputation for himself.

On the other end of the box is stamped the number of apples in the box, the packer's number, the grower's name, and the word "fancy." Every consumer on buying a box of apples knows that he is getting a definite number.

QUESTION: How are boxed apples going to be placed in the car without bruising?

ANSWER: The boxes are placed on their sides. Cleats are laid between the layers, thus allowing for the spring of the car.

QUESTION: Is there any difference in carrying, whether the fruit is packed on the end or on the cheek?

ANSWER: There may be, but it can hardly be avoided if the proper bulge is to be secured. Certain varieties, like the Spitzenburg, pack up better on the cheek.

SPRAYING FOR SAN JOSE SCALE AND CODLING MOTH.

PROF. THOMAS B. SYMONS, *State Entomologist, College Park, Md.*

Mr. Chairman, Ladies and Gentlemen: I congratulate the members of this association on having such an active county organization. I indeed consider it a great privilege to be with you this morning. As Lincoln, not far from this spot, urged his fellow countrymen to save the Union, so I urge you to wage relentless war against injurious insects.

I gave your secretary the subject for this morning's talk rather hurriedly, and I would ask the chairman not to hold me strictly to the title of the address, as I wish to mention at least one other insect that is of considerable importance at this time.

we are a mighty small proposition among 90,000,000 of people. It is only by combining, as you gentlemen are doing, that you can get the results you desire; and in order for the farmers to get their just results, it will be necessary to combine to compete successfully with those interests that also combine. And the sooner the farmers of the East and West appreciate that point, the sooner they will get a more just reward for their efforts.

In discussing the San José scale, I recognize that you men are up-to-date, and have been spraying for San José scale for many years past. I believe that the men whose faces I am looking into, have long since appreciated the fact that they are not afraid of the San José scale; that it can be controlled. We have learned that. The only point, and the prevailing question that is asked to-day in regard to the San José scale, is; What solution is the most effective, the easiest to apply, and the cheapest. We have learned the most effective solution. The home-made lime-sulphur wash has been thoroughly established as an efficient remedy for this pest, but the question confronting the farmers and fruit growers of to-day is to get a solution that is effective, is also easy to apply, and cheap.

The conditions governing the application of spray materials are of considerable importance in emphasizing the ease of application. The labor problem is presented to every farmer; and if he can get a remedy which he can have easily applied, and more satisfactorily applied by his laborers, he is after that solution. The manufacturing people appreciate that condition, and have been constantly putting on the market various solutions looking towards the control of this pest. They finally learned that the growers wanted to use lime-sulphur, and they have now put on the market several brands of lime-sulphur solution. I would say my remarks upon the different solutions are based upon my experiments conducted during the past two years in orchards. I wanted to know, first, whether a concentrated lime-sulphur solution would be as effective as a home-made one; and in order to learn that it was necessary to test it on the trees. I have done this for two years,—the past year more extensively than the previous one; and from the results of the past year, so far as we could observe from careful examination on peach and apple, sprayed in fall and spring, it seems that some of the concentrated solutions have compared favorably with the home-made wash. They have done all that is to be expected of them, both on apple and peach. I'll have to admit that the past season has been a very easy one, so to speak, for the solutions to control the scale. We had an exceedingly dry season in this part of the world, and, as you know, the lime-sulphur remedy controls the scale by virtue of its lasting qualities on the trees,—rather than the immediate effect when applied,—and by having less rain, the wash remained on the trees, and thereby cleaned up the little tiny crawling young reproduced in June and July. So,



Fig. 7.—Apples from Unsprayed Trees. Large Pile, Culls. Small Pile on the Right, Saleable Fruit.



that cannot hurt your trees, no matter who does the spraying, or how it is done. I also recognize that it does not spread quite as readily as the oil; and that's the only point in favor of the oils that makes them advantageous on apples; and in my experience covering ten year's of experiments, I have been able to get just as good results from lime-sulphur on apples as from oil; but I grant you it requires more thorough work. The San José scale is harder to control on the apple than on the peach.

SEVERAL BRANDS OF LIME-SULPHUR WERE USED IN OUR TESTS.

Practically speaking, they are about on the same basis, and practically speaking, it is up to the individual whether he wishes to use the commercial compounds or to make his own lime-sulphur. If he has gone to the expense of buying a boiler, the latter is decidedly the cheaper wash. It is in my opinion the best wash when you make it properly; but in considering the labor, the trouble in making it, the commercial solutions offer quite an inducement to use them; and my advice to the fruit growers is to simply put it on a financial basis. If you have a man that will handle and make the home-made, and you have everything for making it, I should certainly use it. If, on the other hand, you do not wish to go to that trouble, you have the concentrated wash from which you certainly can reasonably expect the same results.

OSAGE ORANGE HEDGE.

Another thing I want to call your attention to, is the fact of the Osage hedge being a common breeding place for the San José scale. I believe you do not have much of this hedge in this county. Maryland has large quantities of it. The Osage Orange hedge is a dear one to any farmer. It is a nuisance. It is a make-shift fence at the best, and cannot be counted upon to turn cattle. It is expensive to keep in shape, and certainly the work of trimming it is very disagreeable work. The expense of keeping it in shape will be more than that of replacing it with a good wire fence. It draws on the land ten to fifteen feet for food and moisture. Finally, I have made careful observation of the Osage hedge in Maryland, and have not seen one that was not infested; and they simply serve as distributing points to other places. I certainly urge men to eliminate this form of hedge from their farms. Washington county has considerable of it.

PEACH LECANIUM.

The Peach Lecanium, or Terrapin scale, is a pest we have known for the past half a dozen years, but one that we had not looked upon as being a serious pest, or which we had entertained any doubts of being able to control. The past season, however, has changed our opinion on it. It has spread rapidly in Maryland. I know in one case, from responsible hearsay, that it occurs in Pennsylvania. I understand that Mr. Wertz has an infestation in his orchard. I do not know as to other conditions in the State. I know, however, that in our State it has caused considerable loss to the smaller growers this past season, and I ask you all to look out for it. You will

observe that it is a tiny scale, but much larger than the San Jose, belonging to a larger class of scale insects. San Jose is a hard scale, the Lecanium is a soft scale. In 1907 we observed this pest in Maryland, and in one orchard at Smithsburg it was starting on a few trees. So I had one of my assistants take up some work on it. We had previously had infestations at College Park on plum trees. It was not until 1908 that it was found to be indigenous to Pennsylvania, New York, and some of the Western States, and most of the states east of the Mississippi. It seems to have a general range of distribution, and has not been of any marked importance except during the last year. It was found to affect the plum and peach tree primarily, but will also be found in others, as, for instance, the sycamore and oak. In the plum orchard at the college, it was found that there was a fungus there that cleaned it out; and that started our work in the orchard at Smithsburg. I will cite briefly the manner of injury by this pest. It does not do its injury as does the San José scale. The San José scale does its injury by devitalizing the tree, sucking the juices of the tree, and killing it. This insect, though sucking the juices of the tree and leaves, does not seem to kill the trees outright to the extent that the San José scale does. It seems to attack only the outer twigs, leaving the larger limbs free, and therefore, does not kill the tree; but the injury is due to the fact that the scale insect secretes a honey dew, which gives rise to a dark fungus that lives on the honey dew, and affects the fruit. This fungus spreads all over the fruit on the tree, making it dark, unpresentable, and unsalable, and the loss has been due to the fact that the fungus scarred the fruit, so as to make it unsalable at the proper prices. So, it is a question of considerable importance, and the spread of it this year leads us to believe that we have certainly got to get after it; and the question is, how should we get after it. In our tests with the lime-sulphur and the miscible oils in 1907, we secured fairly good results. Thinking that the lime-sulphur would be sufficient, and that the orchards that had been sprayed with lime-sulphur for the San Jose would be protected, we felt secure. We found, however, that the lime-sulphur made no difference. It spread through the whole orchard. We are up against it as to what to do at the present time. There are several other parties around Smithsburg that have it more or less, but not to the extent of the orchards referred to.

This insect winters as an immature female. Early in the spring it begins to grow, and reaches maturity about the first of May. Later it begins laying eggs, and itself dries up, like the oyster shell scale. The eggs hatch out about the first of June. The young ones crawl out. Instead of inserting their beaks on the limbs, as does the San José scale, these insects go out on the leaves, up and down the ribs on the under side of the leaves. If you examine the peach trees the first of June, you will find a soft, flat little scale out on the under side of the leaves up and down the mid rib. They stay there six weeks, secreting their honey dew, and the fungus drops down and gets all over the peaches. In about six weeks they return from the leaves to the twigs, and remain there, developing over winter as an immature female. This scale is unique in its habits, in that it infests both the twigs and the foliage. We had thought that spraying the trees just as the eggs are hatched, or when they are going out on

the leaves, with kerosene emulsion, would kill them; but this did not prove to be the case. The emulsion should be applied just as the eggs are hatched. I cannot at this moment give you any advice as to the controlling of this pest; but experiments are under way, and we do know that so far the oils seem to be effective. I was in an orchard about the 10th of December, where the oils had been applied a week previous, and quite a number of the scale had been killed.

PRACTICAL PRINCIPLES FOR PROFITABLE PEACH PRODUCTION.

MR. CHARLES E. BASSETT, *Fennville, Michigan.*

Being a commercial peach grower in the Michigan fruit belt, I shall only attempt to give you briefly the common principles and practices of the leading growers of our section. We attempt no fancy methods—every dollar expended and every hour's work devoted to the business is looked upon as an investment. With most of us, peach production is a "bread and butter" affair. Your own experience with local conditions will enable you to judge just how far our methods can be followed successfully in your several orchards.

SOIL AND LOCATION.

While a good loam is our ideal soil, we have good orchards on nearly all kinds of soil. We do demand, however, that all peach lands shall be well drained, both as to air and water, and, as moderate elevations tend to furnish both a good air circulation and water drainage, high or elevated lands are preferred.

PREPARATION OF SOIL.

The ground to receive our baby trees must be well stocked in advance with suitable food to give them a vigorous start. Plowing under clover or other nitrogenous crops, before setting the trees, furnishes humus, which is especially valuable in making the ground spongy—capable of holding large quantities of water.

VARIETIES.

The choice of varieties is largely a local matter. Select those which do best in your locality and which supply the demands of your market. The large plantings of peach in Georgia, Texas, etc., have caused us to discard the early varieties, especially the clingings. In our section the best commercial orchards include such kinds as the Yellow St. John, Engle's Mammoth, Conklin, Fitzgerald, Elberta, Kalamazoo, New Prolific, Smock and Salway—all yellow varieties. The Champion is one of the leading white kinds, but our market

calls for large, high colored, yellow peaches. Such kinds as the Barnard, Crosby and Gold Drop are excellent in quality, but are too small, under ordinary cultivation, to be wanted by our buyers. Despite its poor quality, the size color and shipping ability of the Elberta makes it the leading market peach.

CULTIVATION.

Our main object being quick and large cash returns, we do our utmost to force a strong, sound growth from the start by intensive cultivation EARLY in the season. Corn has been commonly grown the first two seasons between the trees, it being thought that the loss of fertility occasioned by the feeding of the corn being partly balanced by the corn's shade to the trees from the scalding rays of the sun. Later and better practice seems to omit all crops and give all the land to the peach trees. The trees are headed low—not over 18 inches from the ground—and this calls for special tools in cultivating. The extension disc harrow and the extension fine tooth drag are some of the best tools after the second year, when the trees are given the whole of the ground. Cultivation must be kept up each week to save soil moisture and make more plant food available, by bringing the small particles of soil in contact with the air.

PRUNING AND THINNING.

Just as a fond parent corrects in his infant child any faults that may appear, so the true lover of trees, from the very first season, rubs off any buds that appear where a limb or twig is not desired, and he thus forms a correct hearty tree, a common mistake is to leave the forming of the head of the tree till it is three or four years old, when good-sized limbs must be cut, leaving large scars that are hard to heal and which often leave a weakness. Allowing unnecessary limbs to grow is also a great waste of plant energy. In fact, our former methods of horticulture seem to have been based upon the principles of forestry rather than upon those of fruit production. The engineer who would attempt to run a ten horse-power engine with a five horse-power boiler would be no more lacking in judgment than is the fruit grower who permits his tree to over-balance the root system that is called upon to sustain it. Build up that root system by continuous and intelligent feeding and then restrict the labor of the tree by annual pruning and thinning. Prune as far to

exhaustive process and the trees must be given all possible relief by reducing the number of fruits. Stronger and longer lived trees, larger sized fruits and doubled profits will thereby result.

DISEASES AND INSECTS.

Curl leaf develops during cool, moist weather, but a thorough spraying of the dormant trees in March with a solution of two pounds of copper sulphate (blue vitriol) to fifty gallons of water is a sure preventive. Since we have been using lime-sulphur to destroy the San José scale on our trees, we find that it is equally as effective in controlling the leaf curl. "Yellows" and "Little Peach" are deadly diseases of unknown origin. There is no known cure and the only safe course is to cut down and destroy by fire all diseased trees as soon as discovered. These diseases can only in that way be held in check, but "experimenting" with these diseases has cost many a grower his entire orchard. The annual "grubbing" of the base of the trees, to destroy the borer, is also necessary—sometimes twice in the season. Many a sick looking peach tree will upon examination be found to be nearly girdled by the peach borer, whose work can be discovered by the gummy substance that exudes from the injured roots. Mounding the earth up and around the base of the tree and then removing the earth after the period of egg laying has passed, is a method of some value and many report good results from applying gas tar to the base of the tree, thus shutting out the borer. The plum curculio is often quite destructive to the peach, but clean cultivation will generally destroy the pupa.

FERTILIZERS.

Stable manure is all right to secure rapid wood growth, but its continued use in large quantities produces wood that is soft and tender—easily injured by the cold winters. However, in our exclusive fruit section, we do not have enough stable manure on our farms to make it possible for us to do much of this kind of "damage." Fertilizers that are rich in potash and phosphoric acid are most valuable, such as unleached hardwood ashes and groundbone. We find great profit from the use of commercial fertilizers, the foundation of which is usually muriate of potash and ground bone from the packing houses.

COVER CROPS.

About the middle or last of August we sow some cover crop in the orchards. Oats and barley have been very good, but the sand vetch is now most popular, as it makes a mammoth growth and also adds considerable nitrogen to the soil, it belonging to the class of legumes. When it first begins to grow, this cover crop acts as a "rubber" crop—taking up the soil moisture and available fertility at a time when we want the trees to stop growing and to ripen their new wood. Later this crop acts as a blanket, to hold the leaves and snow, preventing bare spots on exposed knolls and the consequent deep freezing and root injury. In the spring this cover crop furnishes considerable humus to be turned under and thus improve the mechanical condition of the soil. Clovers would be even better for this purpose, as they furnish considerable plant food, but they have to be left too late in the spring if they get much growth, and they are then

robbing the trees of food and moisture at the time when the trees should be making their best growth. We also find it difficult to get a catch of clover under large bearing trees.

Finally, adopt the most intensive methods, to produce the largest and handsomest specimens, pick and pack them carefully and as near ripe as your market will permit; pack honestly, so that you can guarantee every package; market through some co-operative system that will eliminate as many middle men as possible and, above all things, be "in love with your job" and "Johnny on the spot," and you will be safe in looking for a neat balance on the right side of the ledger at the end of each season.

**ABSTRACT OF THE PROCEEDINGS OF THE STATE
HORTICULTURAL ASSOCIATION OF PENNSYLVANIA,
HELD AT TUNKHANNOCK, PA., JANUARY 11, 12 AND
13, 1910.**

OFFICERS FOR 1910.

PRESIDENT.

Gabriel Hiester, Harrisburg.

VICE PRESIDENTS.

Hon. W. T. Creasy. Catawissa.
F. H. Fassett, Meshoppen.
R. M. Eldon, Aspers.

RECORDING SECRETARY.

Chester J. Tyson, Flora Dale.

CORRESPONDING SECRETARY.

Wm. P. Brinton, Christiana.

TREASURER.

Edwin W. Thomas, King of Prussia.

REPORT OF THE GENERAL FRUIT COMMITTEE.

By JOHN D. HERR, Chairman.

From the standpoint of horticulture, the State of Pennsylvania is divided, like ancient Gaul, into three parts, based on distinct differences in both soil and climate, which is accounted for by the fact that the Allegheny Mountain system crosses the entire State in a diagonal direction from southwest to northwest. The boundaries of these sections, for the purpose of this report, have been based on these physical features as well as the isothermal lines.

Section one comprises all that territory north of the isothermal line 48 degrees of mean annual temperature, which conforms almost with latitude 41 degrees 15 minutes north, except a dip to the south in the western part of the State, so as to include Mercer, Butler and Lawrence counties.

Section three consists of the southeastern part of the State and is bounded by an imaginary line starting at the north end of Bucks county and extending in a northwesterly direction to the junction of the east and west branches of the Susquehanna River; thence southwest, following the river to the mouth of the Juniata; thence, the range of the Blue Ridge to Mason's and Dixon's line. This boundary coincides almost exactly with the isothermal of 51 degrees mean annual temperature.

Section two comprises the intermediate territory and consists largely of the region covered by the different ranges of the Allegheny Mountains.

This paper is based on the data supplied during the last few weeks by 75 correspondents, representing 50 counties of the State, which reports show much thought and care and great interest, and my sincere thanks are herewith extended to all who have given assistance in this work. The promptness and comprehensiveness of these reports, together with the painstaking care used in making them out, speak well for the future of Horticulture in Pennsylvania. Upon the receipt of these reports, I have carefully tabulated them and this paper contains a resume of the data contained in them.

The yield of apples in Section 3 was above the medium, but far from a full crop. Sections 2 and 1, according to the reports have had a poor crop, with very few exceptions. The Adams-Franklin county apple growing region report the largest yields for the year. The reports on quality and prices coincides about with the yield, having been good in Section 1 and lower in the remainder of the State. The answers to the question, "Is this crop profitable?" have almost universally been in the affirmative, only 5 answers in the negative, and the reasons given are poor soil, too many worms, wet weather, and lack of interest. Successful growers attribute their success to careful attention to the Cardinal Orchard operations, except one case where the report stated that his success was due to accident. Dry weather seems to have been adverse, militating against the fruit grower all over the State, and was without doubt the most discouraging conditions with which he had to deal, as, aside from such measures of cultivation as he could resort to, it was absolutely beyond his control.

I made a special effort to find out the leading commercial apples in each county of the State, and purposely included the question intending to bring out this fact, and I find that in Section 3, the York Imperial comes first, having received 8 mentions out of a possible 18. Smith's Cider, Smokehouse, and Baldwin stand 2d with three votes each. Stayman's Winesap has two; Fallawater and Grime's each have one. Other profitable varieties are Rome Beauty, Mammoth Black Twig, Rambo, Gravenstein, Ben Davis, Jonathan, Crauser, Dominee, Yellow Transparent, Kime, Strine-town Pippin, and Summer Rambo.

In Section 2 the leading apple is Baldwin, which received 21 votes out of a total of 30; Northern Spy comes second with 5 votes, the others being divided between York Imperial, Fallawater and Strine-town Pippin, while other popular varieties of this section are the Rhode Island Greening, Wagner, Ben Davis, Gano, Jonathan, Winesap, Roxbury Russet, Smokehouse, Yellow Transparent, Delaware Winter and Benoni.

The leading apple of Section 1 has proved to be the Baldwin, also with the Northern Spy a close second. Other profitable varieties mentioned are the King, Rhode Island Greening, Maiden-blush, Ben Davis, Hubbardston's Nonesuch, Wealthy, Wagner, Smokehouse, Smith's Cider, Tolman Sweet, Red Astrachan, Bismarck and Belleflower.

There are only a few localities in which the grower reports the packing of apples. It is enlightening to note the large number reporting, who sell their fruit in local markets. This is not surprising when one considers the enormous demand for fruit within the borders of this State of 7,000,000 population, many of them included in the manufacturing towns of the State. No other state in the Union affords a better home market for all kinds of fruit.

The prices of apples in the commercial districts range, as a rule, from \$2.00 to \$2.75 per barrel, the highest price mentioned is \$5.00 per barrel for fancy grades.

The yield of pears is reported poor all over the State, with good and medium varieties selling at good and fair prices, which range from 75 cents to \$2.00 per bushel. The only correspondents reporting the increased commercial pear planting comes from Section No. 2, and these report for the counties of Bedford, Blair, Clarion, Armstrong and Cambria.

The most destructive pests of pears are the San José scale, and pear blight, the universal infection of which is indicated by the fact that all reports except 10 gave blight as an answer to this question. Two reports gave caterpillars, one canker-worm, and one curculio, one codling moth, and one carelessness on the part of the grower.

One good feature of this report is the fact that peach growers give almost universal expression to the good peach yields, good quality and good prices of this fruit in the entire State, except 6 growers from the northern section who report the yield as being poor and attribute the fact to late frosts. The prices of peaches range from \$1.00 to \$4.50 a bushel. The conditions are favorable to the growth of peaches in Sections 3 and 2 except for the dry weather of the last few seasons. The cold winters of the northern tier of counties of the State, make the growing of this fruit rather hazardous. One man reporting his crop is destroyed by frosts three years out of four.

The most destructive pests of the peach are the San José scale, borers and yellows. Brown rot is also reported as well as curculio. It was the chairman's intention to call out all possible preventives of borers and the question inserted in the list. "What successful preventives have been found valuable for this insect?" Unfortunately, it seems this question was somewhat misunderstood, and instead of preventives, the usual answer was the most common cure, consisting of cutting them out with a knife. A few however have answered according to the meaning of the question and painting apple trees with white lead and raw linseed oil, wrapping trees with tar paper, spraying with lime-sulfur mixture, wrapping with wooden veneer, clean culture, mounding and eternal vigilance were mentioned as preventives.

In addition to this I wish to add my own experience with this pest. In the Spring of 1908, I planted, among other trees, 2,000 apple and peach trees, having left 100 trees for which I had no

room, and which were heeled in beside the orchard. During the latter part of the month of June I applied to the trunks of those planted Good's Caustic Potash Whale Oil Soap, two pounds to one gallon of water, but did not apply any to the heeled in trees. In the spring of 1909 I took up the heeled in trees and found that 80 per cent. were infested with borers while on the treated 2,000 trees only one borer was found after a careful search. I would add this treatment therefore to the list in these reports.

One large fruit grower submits as the most destructive pests, that of careless workmen and mules. This statement many of us will heartily endorse because they are not only destructive, but exceedingly hard to control as no spray ever concocted will be in any way effective in checking their miserable ravages.

In answer to the question, "Is brown rot controlled?" the consensus of opinion is in the negative. The most common spray used to prevent rot is Bordeaux mixture, a few prefer to use the self-boiled lime-sulphur solution with indifferent results. This spray seems decidedly to be still in the experimental stage. In answer to the question, is peach culture profitable, we have only a half-dozen "no's" which come from the northern part of the State, and even they admit it to be profitable in favorable locations. This matter of site is exceedingly important in the northern section.

The yield of plums was, as a rule, from medium to very good, with quality fair to good and prices universally good, ranging from \$1.00 to \$3.00 per bushel. Conditions were usually favorable. Most destructive pests are San José scale, rot, curculio, black knot, and Yellows. The most profitable varieties of plum seem to be, 1, Green Gage, 2, German Prune, 3, Lombard, 4, Burbank, 5, Abundance and Moor's Arctic. Two other profitable plums are 6, the York State Prune, and 7, the Damson. One grower reports that he grows mostly the Domestica and that they stand full strength of Bordeaux mixture without injury to the foliage or fruit. Few plums are shipped outside of the State, and the packages in which they are marketed range from the quart box to a half-bushel basket or crate.

The unanimity on the subject of cherry-growing is startling. Practically every correspondent answers by saying that cherry-growing is not largely engaged in, but that it is profitable. The small number of trees being planted may be the cause of its being profitable, but a few of us at least are planting cherry in the hope that the demand will consume more cherries than are already grown, especially in the neighborhood of the larger markets. As to the best varieties, Montgomery is in the lead, with Early Richmond a close second. Other varieties favorably mentioned, are Governor Wood, Black Tartarian, Napoleon, Biggareau, Morello, May Duke, Ida, Windsor, Reine, Hortense.

Excepting in a very few cases the reports state that grape-growing is carried on only for the local market. The success attending the growing of grapes is very good, good and fair. Few localities report none grown and these only in the northern tier of counties. According to the reports there are practically only six varieties of grapes grown in this State which can be considered best varieties, namely: Concord, Niagara, Worden, Moore's Early, Brighton and Isabella.

The most profitable varieties of strawberries seem to be the Sharpless, Haverland, Gandy, Bubach, Wm. Belt, Glen Mary, and Senator Dunlap, in the order mentioned.

In the line of the most profitable varieties of raspberries, the Cumberland is an easy winner. Other varieties frequently mentioned are the Cuthbert, Gregg, Kansas and Lawton.

The Kitatinny, Ward's Eldorado, Taylor and Snyder are among the best varieties of blackberries.

Other small fruits mentioned as profitable are: Currants and gooseberries. The season for vegetables was exceedingly unfavorable to success on account of the general drought all over the State. The crops paying best in the order of their importance are: Potatoes, cabbage, tomatoes, sweet corn, cucumber, beets and celery. The most destructive pests are: Potato bug, potato blight, green aphis, flea beetle, cabbage worm, anthracnose, root maggots and celery rust.

Market gardening is profitable according to the answers to the questions everywhere, except in five counties, in which the market is poor. I might add an extract from a letter of one of the leading market gardeners of the State, who writes: "There is probably no section where rust, blight, fungus, insects or other diseases are as injurious as in this valley. We have borers, yellows, scale, anthracnose, rot, aphids, leaf blight and other pests to contend with as well as frosts and poor soil; also two successive dry seasons, so that the prospects are not very encouraging."

On the subject of pests and sprays, I have gone into considerable details, and in answer to the question, is San José scale held in check? all answer "yes" except 14. Under remedies, I have received 50 answers in favor of lime-sulphur solution and 13 for all other sprays including oils.

In quite a few localities in Section 1 no scales are reported and no spraying is done for this pest. Under the title, "What sprays are not satisfactory?" seven mention the oils. Five of which specify Scalecide, one Target Brand, one crude oil, and in addition to these a few report damage from the use of Bordeaux mixture. I have requested these correspondents to specify distinctly in what this injury consists, and for the Bordeaux mixture the answer is "defoliate the trees," and "russet the fruit," while for the oil injuries the report is, "roughens the bark," "enlarges the lentils," "kills the bark" and "kills the trees."

A report from one of the leading and most successful fruit-growers in the State is that Scalecide gives best results in his orchard. Another that he has used this spray in his apple orchard for 5 years without damage to the trees. While a third equally large grower states he would allow no oils to be used on his trees.

Spraying for Codling moth is largely on the increase and over 50 answered "yes" to this question. Arsenate of lead is the poison most used. Paris green, London purple, arsenate of lime and Pyrox are frequently mentioned as being used. A few mention Bordeaux sprays for the Codling moth in spite of the fact that volumes have been written on the subject of spraying with fungicides for fungus diseases and stomach poisons for chewing insects. The results of Codling moth sprays is universally good without a

dissenting voice. The spray used for fungus diseases is Bordeaux mixture, Pyrox and self-boiled lime-sulphur, although, as brought out by a special question, this material is very little used.

The following results in answer to the question on the presence of pear blight shows that this disease is spreading with frightful rapidity all over the State. The same can be said of collar rot or blight, which is the same disease located on a different part of the tree, but more destructive because it attacks the trunk and thus more readily destroys the entire tree. In reply to the question as to what remedies have been applied for collar rot, the only remedy is that of cutting out the disease, to which I would respectfully add that the wounds should be painted with some solution, followed by a coat of paint, to prevent the destruction of the wood, and also that the remedy published by certain western experiment stations, namely, a mixture of sulphur and lime using one part of sulphur to three parts of lime be applied to the base of the trunks after the diseased parts have been removed.

Injury by mice and rabbits seems to be very common all over the State, and the remedies offered are the use of wooden veneer and screens about the trees, wrapping with tar paper, cleaning up rubbish, tramping the snow about the trees in winter, spreading the prunings through the orchard and catching the mice and shooting the rabbits.

There seems to be a general awakening in the minds of the fruit growers as to the possibilities of the application of fertilizer in the orchard; 37, or one-half the entire number of correspondents answered by stating that commercial fertilizers are being used in the orchards of their respective districts, while those from the southeastern section of the State, where fruit growing is more intensive, report unanimously in the affirmative and most of the negative answers come from the northwestern half of the State, where, as one grower puts it, "fruit growing is left to the beneficent care of a kind Providence." He says further, "I am by no means proud of our fruit growers, as they are not as a rule very progressive."

The composition of fertilizers applied to orchards, consist as a rule, of fertilizers high in potash and phosphoric acid, although many advocate the use of complete fertilizers on the formula of 2, 8 and 10. The results of applying this fertilizer are reported to be excellent, and stable manure is being used by 50 correspondents with good results, except on fertile soil and in peach orchards. Where there has been trouble with blight on apple, pear and quince

On the subject of pruning trees, 55 agree that heavy pruning of peach is necessary, and a few write that light pruning is all that is ever demanded, and a few take the stand that no pruning is necessary. The majority of the growers admit that thinning fruit is profitable, while many say it is not, giving as a reason that the work is too laborious on high trees to be economical. Nearly every correspondent states that to keep honey bees in an orchard is good. A few answer "no." While others declare their antipathy to these busy little insects and for personal reasons refuse to keep them. A few maintain that they are not necessary for the growing of any kind of fruit.

In answer to the question, "Is commercial planting on the increase?" 43 answered in the affirmative. This comprises the greater part of the State, and is in line with information I have received from other sources showing that in the State of Pennsylvania during the last two years an enormous amount of commercial planting has been going on. This is no doubt due to the fair prices received for fruits as already reported and also that the fruit grower is assured of the fact that he can cope successfully with the insect pests and fungus diseases which were up, to recently, the bugbear of the fruit grower.

In the words of one correspondent who writes upon this subject: "Commercial fruit growing is on the increase. The results obtained by a few specialists has encouraged others to follow the example, but their financial account will only be measured by the care, attention and intelligence which they can exert towards making fruit growing a success. Those who are the most successful, work understandingly and leave nothing undone to deserve success. Where the old, haphazard routine is followed, disappointment and consequent loss of money and time is almost inevitable. The opportunities and possibilities are promising, and there is no doubt but what there will be many growers entering the arena who will merit and gain success.

"The work done by the State authorities in combating the pernicious San José scale is invaluable. The total extermination of many large apple orchards was only prevented by their timely action and advice. The damage already done in eastern Pennsylvania is alarming, and even under most favorable conditions, many years will be required to restore the valuable trees that were killed by the scale. What would happen without determined and concerted action is not difficult to contemplate.

New varieties recommended for Section 1 are Mammoth Black Twig, Clearfield Pippin, Winter Banana, Stark and Pewaukee; for Section 2, Stayman Winesap, Rome Beauty and Gravenstein; for Section 3, Sutton Beauty, Banana, Stayman Winesap and Benoni.

In connection with the subject of new varieties I might mention an interesting report from the central part of the State describing an apple tree over 100 years old which is in the habit of bearing both sweet and sour apples simultaneously, and, wonderful to relate, apples sweet on one side and sour on the other. My informant fails to state which side is sweet and which side is sour, but does make it plain that one cannot distinguish these from the others until one eats them. Probably this is the reason he failed to send me specimens for exhibition at this meeting for which I offered to pay him well.

Some light may be thrown upon the awakening of the citizens of this State to the necessities and possibilities of fruit growing within our borders by stating here that when it became known last November that the Bureau of Zoology proposed to enlarge its work by demonstrating methods and supervising orchards on a limited number of premises, within 6 weeks there were over 1,300 orchard owners who applied for this service. This at least shows that these people, many of them owners of thousands of trees, had reached a point in their experience in the work where they were open to instruction. Some of the pleas made for help were so pathetic as to almost provoke tears.

Your chairman begs to submit herewith what are considered as the most urgent needs of the fruit growing interest of the State as follows:

The enlargement of the scope of the work of the State Department of Agriculture in order that the assistance called for by the citizens of the State can be supplied either through the Bureau of Zoology or otherwise, so that fruit growing in Pennsylvania will be put on the high plane its importance and the natural advantages offered here deserve.

Co-operative buying of supplies by this association, thereby insuring a better grade of materials as well as a saving of from 20 to 40 per cent. on all purchases and incidentally largely increasing the membership of the society.

A law standardizing spraying chemicals, thus insuring the orchardist against failure on account of adulteration.

A survey of the fruit soils of the State for the use of prospective planters in selecting profitable varieties.

SOME WESTERN APPLE METHODS.

By H. F. HERSEY, East Petersburg, Pa.

Much has been and is still being written of the methods of the western apple growers and the fine apples they produce. Many sections, as the Hood River Valley, Oregon, the White Salmon District, the Wenatchee and the Yakima Valleys, Washington, and numerous other sections are known from the Pacific to the Atlantic coast and even farther than this. The people of Great Britain, Germany, France and other European countries eat their apples and pay a high price for the privilege of doing so. Why is this true? It is because the people of the west are alive and looking for every opportunity to advertise and make their apples better known throughout the world.

In treating my subject I shall confine myself to the Hood River Valley, Oregon, as I am better acquainted with that valley than any other western district, and the methods vary but little at other places. It might be well to explain the reason of my visit to this

district. The Department of Horticulture of the School of Agriculture of the Pennsylvania State College requires in its course that some time after the Junior year be spent in some large commercial orchard or some well-known fruit district, for the purpose of making a study of methods used, market conditions, etc. It is entirely optional with the student as to where he wishes to do the work, but suggestions are given. One of my classmates and myself took Hood River Valley, Oregon, as the place to do this work. We were furnished blanks by the Department as an outline.

Hood River Valley is situated in the midst of the Cascade Mountains, along the Columbia River, and 65 miles east of Portland. The valley, as it is called, is seemingly a plateau and is drained by the Hood River which has its sources in the glaciers of Mt. Hood. Mt. Hood stands in the southern end of the Valley and Mt. Adams is just across the Columbia River in Washington. These two snow-capped mountains give the valley a cool climate in summer. The valley has three natural divisions—the west side, which lies between Hood River and west to the mountains; the east side, or the portion lying east of the river, and extending southward to about ten miles from the Columbia, and south of this extending for ten or twelve miles is the Upper Valley. This is a narrower and much higher valley and merges into the foothills of Mt. Hood. Only a small portion of it is cleared and set to fruit trees. The first two divisions named are where most of the fruit is grown. The valley is about 25 miles long and from 5 to 10 miles wide. It is indeed a very small place to have such a great reputation. Hood River is the principal town and there are several smaller towns scattered throughout the valley.

Methods of planting or setting out are practically the same as those used here in the east. The square, hexagonal, and quincunx methods are chiefly used. Planting distances as a rule are much closer than in the east for several reasons: (1) the trees do not live as long and (2) they do not attain such a large size. They are planted 25 feet apart and sometimes even closer.

The soils are mostly derived from volcanic ashes and as a general rule are very light in texture. Six soil types are found in the valley and the one occurring to the greatest extent is known as volcanic ash. Nearly all of the orchards are planted on this soil type. The soils being light and as rainfall is not very plentiful irrigation is practiced to some extent. Strawberries are grown quite extensively in the orchards on the east side of the river, and here irrigation is necessary. When the orchards are not intercropped, irrigation is seldom practiced. Many of the growers think that if the orchard become accustomed to plenty of water, and so demand it all the time. In other words the trees can be trained. As good results are obtained from non-irrigated orchards as from those that are irrigated. The water used in irrigation is brought all the way from Mt. Hood in canals along the sides of the mountain and is then distributed through the valley by means of laterals. The rill method is used chiefly in the orchards.

No sod mulch is used at any place in the valley. The dust mulch is counted upon to keep up the water content and a good mulch is always maintained. The orchard is gone over about every ten days with a spike tooth harrow and in every orchard into which

I walked I could kick the loose earth away to the depth of several inches and underneath that I would always find a good moist soil. The average rainfall is not over twenty inches and most of this comes in the form of snow during the winter. It very rarely rains during the summer and yet they give their trees all the water they need by maintaining a good soil mulch. Many of our eastern growers might have better success if they give this point more attention.

Cover crops are used to some extent but not as a general rule. When they are used they are sown about the middle of August and then disced in during the early spring. Crimson clover is used most largely but vetch and rye are also used to some extent. A number of the growers think that the time is not far distant when every one will be using cover crops.

Hood River Valley is comparatively a new country and there are not many orchards older than fifteen years. The orchards were all set out in the virgin soil and as the soil is of light texture, the older orchards are beginning to lack some of the essential elements of plant food. So in these orchards commercial fertilizers are used to a limited extent but their use is not general. The leading growers are of the opinion that in a few years fertilizers will be applied more generally and with results that will make their use more acceptable.

Both winter and summer pruning are practiced and there are some few of the growers who rely on summer pruning alone but they are the exception rather than the rule. A larger number prune both in winter and summer but by far the greater percentage prune in winter only. The open center tree is preferred and in nearly every instance the trees are headed low, 18 to 20 inches from the ground. In winter pruning the tree is shaped while in summer the water sprouts and cross limbs are cut out. As a general rule pruning is well done and careful attention is given to it, but every one has his own ideas as to the way it should be done, and so the same methods are not in vogue throughout the valley.

The fruit grower in Hood River is troubled very little with fungus diseases. One of the chief reasons for this is their effective methods of spraying. It has been said that there is a cloud of spray continually floating over Hood River Valley. This statement is somewhat exaggerated but the fact still remains that they do a great deal of spraying. Some of the fungus diseases found are anthracnose, mildew and apple scab. The rots are not troublesome. Bordeaux mixture is the fungicide most commonly used and good results are obtained from it.

The codling moth and aphid are among the most troublesome in-

twigs in the central or shaded portion of the tree. The growth of many twigs is entirely stopped and others are weakened and caused to grow crooked. Their work lasts for only a short time as they disappear on the approach of warm weather. The green aphid is much more plentiful and more persistent but is more easily controlled by insecticides although several sprayings are often necessary. An extract of quassia chips and whale oil soap is in general favor as a remedy, and by far the greater number of growers use it, generally applying it several times. Kerosene emulsion and formaldehyde soap are also used.

The codling moth always was and always will be a serious pest and it is only kept down by a very close attention to spraying. Lead arsenate is the insecticide used and it is used with the best results. The home-made preparations have been abandoned for the commercial brands. A large number make the first spraying just as soon as the petals have fallen and others spray just as soon as the weather conditions are favorable. All agree that four, five and six sprayings are necessary for the best results and a few give a less number than four. The general idea is to keep the apple well covered with the arsenate and as this is a district of little rain it is not very hard to do. The first sprayings are generally made at intervals of ten days and the last few at intervals of about fifteen days. Those who have power pumps always try to fill the calyx cup at the first spraying as they think that it is more effective.

The orchards as a rule are small and the average size for the valley is about sixteen acres. I do not think that there is one orchard over seventy acres in area. In the small orchards the hand pump sprayer is used while in orchards twenty-five to thirty acres in area the power sprayer is the general rule.

The leading apples grown in the district are the Yellow Newton and the Spitzenburg. Ten to twelve years ago a great many varieties were planted in a single orchard. This was found to be unprofitable and a large number of the varieties were topworked with the Yellow Newton and Spitzenburg. The later plantings have nearly all been of the varieties named. The reason for these two varieties being so popular is that they are good bearers, good shippers, good keepers, and high in quality. Then, too, they take on a high color and put up a good appearance. The Ben Davis, Arkansas Black, and Jonathan are also grown to a limited extent.

The general opinion in the valley is that the Newtowns and Spitzenburgs need to be pollinated for the best results by some other variety. The Ortley and Arkansas Black are considered to be good pollinizers and are found scattered through many of the orchards. It has been demonstrated by actual experiment that these apples need to be pollinated but it seems to be the consensus of opinion that they must.

One thing that seems very peculiar in spite of the reported high yields and large profits made is, that many of the owners have only bought their land recently and paid a high price for it. Many of the people are willing to sell but the price ranges from \$1,000 to \$2,000 per acre. This buying and selling seems to be characteristic of the west and should not be taken as a sign that these lands are not giving a good return for the money invested. On account of this fact it was rather hard to get yields from the growers. The yields vary from 150 boxes to 500 boxes per acre of first class

apples. The price per box for the last few years has ranged from \$2.00 to \$3.15 per box and some of the apples have sold for even higher prices than this. The income per acre ranges from \$300 to \$2,000, the last named being very high and the average being about \$500.

All of the apples are marketed in New York and London by the Hood River Fruit Grower's Association. Every apple of the valley is handled by professional packers, who pack the product of all the orchards to a uniform grade, in one bushel boxes, and none of the growers are permitted to pack their own fruit. The grower's name, variety, and the number of apples in the box are found on the outside on a fancy label. The box is always lined with fancy paper. The Hood River Fruit Grower's Association is to be commended for the thorough manner in which they do their work. Every box is inspected and such is their reputation that apples are ordered by telegraph in car load lots at the highest prices without the buyers ever seeing the fruit. The apples are sorted and packed according to size, exactly the same number of apples going into each box. These sizes run from 54 to 128 in a box, the designation being 3½, 4, 4½ and 5 tier fruit. This is certainly an enviable reputation to have and it clearly shows the value of a brand or label with an honest man or men behind it.

It is very interesting to note the class of people who have made Hood River Valley their home. Here is a professor who had taught in one of the eastern colleges. Here is a Yale and there a Princeton graduate. I will give an example of a Yale graduate and a graduate of the Boston Institute of Technology. These two young men were partners and evidently had plenty of money. They had come to the valley about three years ago and purchased about thirty acres of orchard land at \$1,000 per acre. They were living in princely style, said they were making money, enjoyed the life immensely and had been offered \$1,500 per acre only a few days prior to our visit and would not consider it. It was no uncommon occurrence to find a grower away from home on a pleasure trip either to New York or California, or some other place. The people as a whole are very sociable and readily give any information asked. My opinion of the valley is that it is a place for the capitalist and not a place for the poor man who has to make a start.

It would seem that the eastern grower would not have a chance to compete with the western apples. The eastern apples have one thing which is becoming of more importance every year, namely quality and many of the western apples do not have good quality. A striking example of this point was made at the meeting of the Pennsylvania State Grange held at State College, December 21 to 24. Rogue River, Oregon, Spitzenburg and Newtowns were pitted against Pennsylvania Baldwins, Grime's Golden and Stayman Winesap. The Baldwins were grown in Perry county by our honorable President, Mr. Heister, and the Grime's Golden and Stayman in Adams county. The Pennsylvania apples won out on their merits both as to quality and color. A committee of three competent apple growers gave their decision in favor of our apples and the audience voted the same way. Considering everything and when the Pennsylvania apple growers as a whole, as is being done in some sections, apply the methods of the west there is a bright day ahead for the apple grower of Pennsylvania.

GRAPE CULTURE.

By FRANCIS NEWTON THORPE, PH. D., LL.D., Mt. Holly, N. J.

Mr. President, Ladies and Gentlemen: Some of you may think it a little far-fetched to present for discussion to the State Horticultural Association, the subject of Viticulture—the growing of grapes for commercial purposes.

I am reminded of what a friend of mine said he had learned from the prayer book, regarding marriage. He says that according to the prayer book a man can have sixteen wives, and be married in sixteen ways—four better, four worse, four richer and four poorer. Now, the subject of Viticulture is something like that.

Some twenty-two or twenty-three years ago I became interested in the production of the grape. The work has gone on steadily and uninterruptedly. My experience has been among those who paid high for the truth, and enjoyed a very respectable proportion of the returns. We have received a net profit of a hundred to a hundred and twenty-five dollars per acre, and we have on the other hand experienced the delights of postponing the payments of bills. Nevertheless, the culture of the grape for commercial purposes is a practical problem, which is determined to a large degree by natural conditions. If you want to raise grapes you must not farm upon the imagination; you must stick closely to facts, and put yourself in harmony with the laws of nature.

The cultivation of the grape in Erie county has been followed for the past fifty-two years. It so happens that a part of my own vineyard was among the first that were put out. The two great principles in viticulture are, first, climate, and secondly, care. In this part of the State (Wyoming county), where you have such a wonderful opportunity for the production of the apple, perhaps you will not be greatly interested in the details of the production of the grape in Erie county. Most people, when they have a few vines, think they have a vineyard. In Erie county there is an acreage of about seven thousand acres devoted to the grape alone, some parts of which are in a very high state of cultivation. On the other hand we have among us men who think all that is necessary is to put in the hand and take out the fruit. Any soil that is adapted to the production of the grape is very soon exhausted. We must understand that we are the prisoners of climate and servants of the soil.

To grow grapes successfully, we must have a climate that does not drop in temperature below 25 degrees, nor rise above a hundred degrees. Of course, that is a very wide range for the cultivation of any fruit. In the Italian vineyards, the temperature is regulated by the Pyrenees, and the Alps, mountain protectors to which is largely due the success of the vine in Italy. On the Pacific Coast of our country the mountains have a great deal to do with the production of a fine grade of fruit.

Another important factor in the successful production of the grape is the saturation of the atmosphere. Poor vineyards are sometimes due to trying to raise grapes in a climate that will germinate fungus. In the cranberry bogs of New Jersey, as well as in the vineyards of the North East, the point of saturation of the air has much to do with results. It is doubtful whether grapes can be raised successfully in New Jersey, owing to the humidity of the atmosphere. Whether one can raise enough grapes to pay for his trouble and leave a little margin of profit, depends very largely upon climatic conditions. The happy man in viticulture is he who lives in a belt where the most favorable conditions are likely to surround him.

The vineyards, like the human skin, has to be ventilated, and growers are learning that they must so regulate their vines as to give them a free circulation of air and sunshine.

In Germany, where labor is at the bottom of the scale, viticulture is easily made more profitable than it is with us in the United States, where labor is at the top of the scale. One has to raise a great deal of anything to make it profitable. After climate and saturation, comes the question of labor. Not only must the high cost but the quality of labor be considered with us. We must have a labor that can be depended on—one that will not leave us on the slightest provocation, at the critical moment, and leave our crop to ruin. We know the importance of the proper kind of soil in our work, but after all experiments that have been made, we must come to the conclusion that soil is a thing that can be created. I believe that given anything that will take sunshine, and a little water, one can make soil. In Germany I have seen women carry soil on their heads in a little basket to the tops of the hills, and I suppose they planted vines in it, because there were other vines there.

We must not only have the climate, and the soil, and the water, and the sunshine, and the atmospheric conditions, but we must also have the labor and that is where man comes in. Moisture, heat and light are the parents of our food, and the foster parent, man, can supply the nourishment necessary to make that climate and soil and heat respond; then there is nothing that will prevent successful commercial production of fruit.

I think the best kind of soil is a sandy soil, but I have seen grapes grown very successfully on soil that was once the bed of a glacial river. I have a friend in North East who has such a soil as this. He is a graduate of the University of Michigan, and very fond of chemistry, so he took the pieces of rock from the glacial river bed and put them through the mill, to make a soil on which he planted a vineyard,—a vineyard as promising as any I have ever seen on sandy soil. Near his land is a cider mill. He covered his rocky land with pomice and so created a rich, warm soil. It was a very discouraging proposition, but it simply shows what can be done. He is realizing from that soil now, from ninety to a hundred and ten dollars an acre. Soil is a relative circumstance; it is the alembic of human labor. Of course, if climate and soil are given us, it is all we can ask.

The story of the vineyard is not one of unbroken profit. It is my experience that an orchard or vine that can be retarded in the spring, will ripen more fruit than one in which the bees swarm in



FIG. 1.—“CONCORDS.”

From a photograph of a small corner of “Indian Arrow Vineyards,” the property of Francis Newton Thorpe, at North East, Erie Co., Pa. Vines set in 1894 and photographed on October 1, 1906. Note the beautifully uniform vines, heavily loaded with fruit.

April. We don't want early orchards, and we don't want early blossoms. We want them so regulated, in our belt, that the sun's rays, when it crosses the line, will not start the sap too soon; nor must late frosts nip the vines about six weeks after they have been in blossom. A northern exposure is the best protection against these dangers.

It is now twenty-two years since I began to raise grapes, and the results of my experience can perhaps be illustrated by a story. It was at the time when the administration was trying to start our banking system, and float our national greenbacks, that General Patterson, of Philadelphia, gave a dinner to Salmon P. Chase and some other prominent men. Mr. Chase was in favor of inscribing on the greenbacks a passage from the Bible, or from George Washington's writings, that might inspire the confidence of the people in them. The bankers present, perhaps not familiar with the writings of Washington, could not suggest any appropriate quotation, when Gen. Patterson said he recalled one passage from the Bible which he thought would be satisfactory: "Silver and gold have I none, but such as I have, give I unto thee." It is a good deal so in raising grapes; we don't always have silver or gold, even after we have sold our fruit at high prices. It may be easy to raise five or six tons and make no more money than by producing three or four. You are dependent upon the market, and upon general market conditions. Of course, that brings up the question of the marketing of fruit, which is a rather large question to discuss in such an informal talk as this.

It does not follow that you will have a large amount of money for your fruit if you try to cheat the ground. You cannot take from three to five tons off an acre of land, and have it produce the same year after year. You must put something back. You not only have to keep land in its natural state of health, but you have to stimulate it, as we stimulate athletes, and our young men in our universities. Our going to school is an artificial way of living. We could live without learning to read. We must do with the soil something as we do with our children and our neighbor's children. We must give the soil an opportunity. We must put the vine into a friendly soil, and then feed it and cultivate it. We have learned that nature starts it off well and that all that remains for us to do is to feed it and cultivate it. We cannot expect the cotyledon to grow unless we feed it. We see in the forest a large dropping of seeds. Those that get moisture from the soil and live in the sunshine, survive. The others, not so favorably situated, die. Most of them die; it is the old story of the survival of the fittest.

We must do something to stimulate and feed the plant. I do not believe that a vineyard of five hundred acres would produce ten tons if left to itself. When the French explorers in the 17th century came down from Montreal and Quebec, and penetrated the great Valley of the Mississippi, they made note of the things they saw. They found the vine growing along the south shore of Lake Erie. Where the wild vine will grow the tame or cultivated vine will grow. If nature has shown that Wyoming county is the place to grow apples, then grow apples there; the same with cherries or grapes or any other fruit. You can always depend on nature's hint.

So when Father Hennepin, and other French explorers of that early period record that the wild vine did well on the lake shore, it was a hint to us that it was a good place to grow grapes. The famous vineyards of Erie county now attest the truth that to follow nature is to win success.

But even under the most favorable climatic and soil conditions, the vineyard must be kept fed and stimulated in order to produce well. If neglected one year, it takes several years to get it back to form and the effects of neglect increase in geometrical ratio. From the moment we break soil, until the property passes into the hands of our posterity, it must receive constant attention.

Now, I have noticed that most of the diseases which come to our vineyards are the result of our own carelessness. The law speaks of "acts of God" and "the public enemy;" I believe that our chief enemy in horticulture is our own ignorance and our own cupidity. I can take you through vineyards in Pennsylvania and Western New York which have received the most assiduous attention. They are productive because they are healthy and are cared for in a more or less scientific manner.

As soon as the leaf falls you can begin to trim the grape vine. If you leave a wound that will not cover rapidly, and the sun and rain strike it, fungus growth will cover it, and in the open stub insects will hide, and soon there will be a little nest of bacteria. Nature never leaves an open wound unless the vitality of the plant is low. If you do not cover it, she will. If you will take notice, as you pass from Buffalo to Cleveland, you will see many vineyards which show the effect of a fungus growth and insect pests. They have been neglected or improperly trimmed. Nature has covered them over with disease. These insects and fungus growths are beneficent though they are our enemies. I have discovered larvæ down among the roots of my own vines, although I owned the vineyard for sixteen or eighteen years before I recognized them. If the Horticultural Society and the scientists started in to tell us what they don't know about these insects and diseases, they could tell us a great deal more than when they try to tell us what they know. There is a certain resemblance between a man and his business. I am inclined to think that this so-called technical knowledge, before it is of any value, has to come from the alembic of experiment, experience and trial; and very often the theories of our scientific brethren are of less value than the judgment of the men of instinct. We have in our community a good many Germans from families who came to this country fifty years ago, and later started vineyards. With characteristic German energy they worked their vineyards with precision and profit. The successful man is instinctively what he is—horticulturalist, lawyer, clergymen, whatever it may be, and much of his success is due to his instinctive knowledge, rather than to his scientific training. I would not start in the fruit business the same way I would go into Wanamaker's and order a dozen collars. A gentleman here tells me that he is going into the orchard business because he likes it. That is the only way to do it. Most of us are obliged to check off values, but over against this dollar return there is the healthful surroundings, and the closeness to nature and to mother earth, which you cannot get anywhere more happily than in horticulture.

I love horticulture, and think it has as beneficial an effect on character as the Thirty-nine Articles. Most of us are inclined to look at the dollar value of a thing too much. When Emerson died, a man riding on the train saw in the paper the account of his death. He exclaimed: "Emerson is dead, and he left two hundred and fifty thousand dollars. Why! he was quite a man!" That was the important point—he left two hundred and fifty thousand dollars. That was all he could see in Emerson.

A good vineyard increases the value of the land. Twenty years ago I paid four hundred dollars an acre for my land. I have been offered more for it many times since. A gentleman from Montreal, Manager of the Bell Telephone Company there, a few summers ago, bought a vineyard at North East, for which he paid five hundred dollars an acre. I don't know of any good vineyard that has sold there for less than three hundred dollars an acre—and some sold at that price was not the best land, by any means.

I have known farmers who would persist in raising things that cost more than they are worth. As the old saying has it, they will do as their fathers did. Now, this very land that sells at from three to five hundred dollars an acre, twenty years ago was ordinary farming land, worth from \$45 to \$120 an acre. It possessed the same vitality then that it does now, but I have no doubt if it had been put out in vineyards seventy-five years ago, it would have yielded no adequate return for the labor, because there was then no demand for the fruit. We are now in a position, in America, where any first-class fruit will find a market. The middleman may for a time keep us out of our just profits, but we own the land and have the title, and "sometimes, we know not how or where, we shall surely come to our own." I am not afraid of overdoing the fruit business. There was a time when we could not have gotten rid of the grapes up in Erie county, any more than you could of your apples here in Wyoming county; but all that has changed. Our people are becoming every year greater consumers of fruit. There is no better investment than first-class fruit land. It is safer and pays better returns than an equivalent amount invested in railroad shares or bank stock. I am more and more impressed, as I grow older, and see the perils of investing money, by the opportunity offered by horticulture to the man who has ten, twenty, or thirty thousand dollars to invest. If it does not make him rich, it will at least keep him from the house that is poorer than his own. Law or medicine are all right, but give me the land. You are always sure of a return if you produce something that some one else wants.

Another important point is the handling and packing of the fruit. I have seen fruit on Chestnut Street from some of our vineyards so carelessly packed that it had been crushed and bruised in transit, and of such poor quality that it for a time destroyed the reputation of the vineyard. I will give you people the credit of doing the right thing in packing your fruit; we do not always do it at the lake shore. We are tricky, and if we find something that is not up to standard, some of us say: "Oh, well, stick it in; I have my check."

If time permitted, and it were worth while, I would like to enter into the larger problem of marketing. Our crops seem to be produced, to a large extent, for the benefit of the middleman. Now,

we are willing to be the middleman, and if necessary, the two end men also, ourselves. I have seen grapes sell in Philadelphia at four cents a pound, for which we at the shore received seven-eights of a cent. Still, I believe that a man gets about all out of the world that he is entitled to. That is not original with me. General Grant said it, as you will find if you read his Memoirs. Daniel Webster was Daniel Webster; he could not very well have been anything else, because God made him so. If we manage our marketing right, we will get our due share of the returns.

Our scientific friends at Washington are great advocates of spraying for the root worm. It will not harm the worm, they tell us, but it will destroy his posterity. I would rather have something that will destroy the old man himself than turn my vine over to him in the hope of destroying his grand-nephew. I don't believe in sneering at our friends at Washington, however; they are probably doing the best they know how. But this little corkscrew of a beetle that goes through the vine—straight through, if you will let him—if you take him out and expose him to sufficient sunlight, in early June, will shrivel up and die. Just stir him out of the soil, and expose him to sun and air for half an hour, and that will kill the old man himself, as well as his posterity.

There are big bugs that eat little bugs, and little bugs that eat big bugs. Now, nature loves a grape vine, and does all she can to protect it. There are fungus growths that feed on other fungi, and if any man who loves his vine, will take his magnifying glass, and put on his old clothes, and get down into the dirt, he will find that nature is ever protecting her own. Each species has its claim upon her, to which she will respond, if possible.

Nature gave us thirty-two teeth, and the man who chews his food never knows he has any stomach, or any bile, unless his neighbors stir it up. In Couvier's Museum, in Paris, years ago, I saw the skeletons of the old cave dwellers and the Bronze men of Lake Haldstead, in Austria. These men, surrounded by their bronze and stone implements, came down to us with thirty-two sound teeth in their mouths. We are not taking care of our teeth and we lose them and health. The same thing holds true in our grape vines. I take a rather cheerful view of these diseases which come to our vines. It makes us take better care of them, and look after them, and, as a result, they become more productive. I believe that all the work of our Horticultural Societies, and of our State College, and of our Department at Washington has the same end in view—to give us a healthy vine which will reproduce itself.

Now, Mr. President, I did not write an address. I thought that an informal account of the Lake Erie grape industry might interest you. Nature has done a great deal for that little town of

the ancient Romans were interested in horticulture and grew grapes; the recent great horticultural work by Ferrero gives us a great deal of information about horticulture in the time of the Republic. The planting of the vine was common in the days of the Cæsars. Viticulture came into England in the time of Henry the Eighth.

You read in this old encyclopedia of the curious tools and implements used by the Romans and Greeks in the days of Alexander the Great. Horticulture to-day is very much like horticulture of old. If you read history and study the Bible, you will find that in old time they had the fungus diseases, bugs, and other troubles in their vineyards as we have to-day. One of the most vivid parables of the Old Testament is the parable of the unfruitful vine.

THE MAKING AND USE OF CONCENTRATED LIME-SULPHUR.

By JOHN P. STEWART, *Experimental Horticulture, State College, Pa.*

Lime-sulphur in the old dilute form has been of service to horticulturists and entomologists since the discovery of its value by F. Dusey, at Fresno, Cal., in 1886. Its first appearance in the east was in 1884, when it was tried in Maryland and pronounced a failure. The ban was partially lifted by the results of a second trial in 1900, but the real beginning of its success in the east dates from Forbes' work in Illinois in 1902.

The material used by Dusey in California was a sheep dip borrowed from a neighbor. To a similar transfer in use, apparently, are we indebted for the beginnings of our knowledge of the value of the concentrated solution as an insecticide. Some sixteen or eighteen years after the first horticultural use of the dilute material, it appears that in Utah it became the practice of certain purchasers of a concentrated dip solution to buy a few extra barrels each season for application to their trees. This dip was prepared by a Stock Food Company, of Omaha, Neb., who corroborated the practice by sending inquiries and samples for trial to several Experiment Stations, and since then they have been regularly marketing their solution as either a dip or insecticide, without modification so far as I have been able to learn. And it is of interest to note, that although the home preparation of storable dips has long been known, it is only recently a storable insecticide has been considered.

Concentrated lime-sulphur as we know it to-day is a water solution of lime-sulphur compounds, of a bright cherry red or reddish amber color, and of a density that practically may run from 1.20 to probably as high as 1.35 (about 24° to 38° Baume). It differs from the ordinary dilute lime-sulphur chiefly in its ability to be stored, in its freedom from objectionable sediment and solids, and in its availability as a summer fungicide.

Solutions of the densities named above solidify or "freeze" at about 17° F. for the lower density and somewhat below 0° F. for the higher. Our experiments indicate that this freezing is rarely

injurious to the solutions, which nearly always recover completely without heating. Their causticity is distinctly less than that of the ordinary dilute material, though without apparent reduction in effectiveness. On continued exposure to air at ordinary temperatures a crust of solids may be formed, which sometimes becomes very thick and objectionable, and at other times remains thin and acts as a protection to the liquid against further solidification. This crust can be readily skinned off with a fine screen and re-dissolved by heating either in water or in the mother liquid. We have prevented it entirely either by covering the solution with a film of oil, or by immediate storing in closed packages which are filled completely.

THE PROBLEM.

The problem of producing a storable lime-sulphur is essentially one of preventing crystal-formation at ordinary temperatures, and of securing a product sufficiently dense to resist freezing and be entitled to storage space. The details of this process are already available in a bulletin of the Pennsylvania Station, so that our purpose here is to present the more general phases of the process and to call attention to some of our reasons for the conclusions given in that publication.

THE MATERIALS.

The materials needed are sulphur and a high grade lime. Flour of sulphur is probably preferable to the flowers because of its reduced cost and lessened tendency to collect in pellets, and present indications are that the still cheaper powdered commercial sulphur, of at least 99 $\frac{1}{2}$ per cent. purity, will be entirely satisfactory in the making of concentrated solutions.

The lime should be as rich in calcium oxid (CaO) and as free of magnesia (MgO) as possible. In our judgment, nothing less than 90 per cent. CaO should be tolerated, though it can be used if necessary, and a lime with 95 per cent. of better of CaO is undoubtedly safer and more satisfactory when it is obtainable. Chemical lime running from 90 per cent. to 95 per cent. is obtainable from the American Lime and Stone Co., of Tyrone, Pa., in lump form for \$3.25 per ton in car lots. It can also be purchased in iron tanks or drums, which prevent deterioration, in less than car lots at \$3.75 per ton. This is the lime used by us in our experiments and a random sample analyzed showed 95.57 per cent. CaO. Lime of similar quality may be obtained at other places in this State, e. g., the York Valley Lime Co., York, Pa.

The exact extent of the harmful effects exerted by magnesium is not entirely clear. But it is known to materially increase the sediment, and there is some evidence that its compounds are at least partly responsible for some of the very fine crystals that occasionally appear in the concentrate in spite of correct handling in other respects.

THE FORMULA.

After securing a lime of proper character, its amount in relation to the sulphur is of greatest importance. It has been shown repeatedly in our experiments that the crystallization and most of

the harsh sediment in the ordinary dilute material are due chiefly to excess of lime. It is interesting to note, also, that this excess of lime crept into the insecticide immediately after its discovery and apparently without sufficient basis in definite experiments. This may be shown by reference to the first formulas used in California.

	Lime. Lbs.	Sulphur. Lbs.	Salt. Lbs.	Sugar. Lbs.	Water. Gal.
1886, Original formula (sheep dip),	80	100	10	20	160
1887, I. H. Thomas,	125	100	75	0	300
1887, A. T. Covell,	250	100	75	0	300

Thus within a single year we find a rise in lime-content from an amount equal to four-fifths of the sulphur to as much as two and a half times its weight. The serious physical objections to this extra lime are evident and its insecticidal value may well be doubted when we note the success of clear solutions and recall the tests of lime conducted by Macoun in Canada, in 1899, and by Piper in Washington, which against San Jose and similar scales resulted negatively in all cases.

Assuming then that the permanent clear solution of polysulphids is our objective point in the preparation of lime-sulphur, the first problem is to determine the correct ratio of ingredients for obtaining it. This may be done either by analyzing the product or by repeated series of trials. By the first method, we have found that 59 analyses of the solution of the present dilute material, collected from publications of Haywood, Penny, and Thatcher, show an average lime-sulphur ratio of 1 to 1.96; 12 analyses of our own and commercial concentrates, examined at the Pennsylvania Station by Penny and Rogers, show an average ratio of 1 to 4.443; and 65 analyses of somewhat denser, commercial "dip" solutions analyzed by Emery of the Federal Bureau of Animal Industry, show an average ratio of 1 to 2.538. Thus, as judged by the composition of the product, a ratio of pure materials which is slightly narrower than 1 to 2 is obtained in dilute lime-sulphur while in the higher concentrates a ratio of about 1 to 2.5 is found. These figures show that a ratio of 1 lb. of lime to 2 lb. of sulphur in the ingredients is well within the limits of actual combination in the concentrated material.

The ratios given above are derived from the actual amounts of chemically pure materials in solution in the finished products. But practically one must deal with commercial limes and sulphurs, and also he must approach the problem from the viewpoint of original ingredients rather than final products. To determine the best ratio of ingredients under actual conditions of preparation, therefore, we tried eleven combinations of which ten are shown in Table I. The lime and sulphur used were commercial and the former contained: 95.57 per cent. CaO; 2.08 per cent. MgO; 1.45 per cent. Al & Fe. The lime, water and boiling periods were kept essentially uniform, while the sulphur was varied from an amount equal to the lime to two and one-fourth times its weight.

Because of the well-known difficulty in dealing with solubilities, of getting identical results even from two products of exactly similar preparation, the problem was dealt with by the method of re-

peated trials and the elimination of error through the plotting of curves from combined results. From these curves, deductions were made of the true values of the various combinations with results as shown in Table I.

TABLE I.

Approximate Results Obtainable from the Use of Different Ratios of Sulphur to Lime.

Formula.			Boiling. Min.	Gallons of 1.08 Spray.	Waste. 1% of product.	Crystals. after 48 hours.
Lime. Lbs.	Sulphur. Lbs.	Water. Gal.				
100	100	100	80	242	.27	Abundant.
100	150	100	80	586	12.5-12	Abundant.
100	170	100	80	700	5	Many.
100	180	100	80	765	2.25	Few.
100	190	100	80	825	0.5	Trace.
100	195	100	80	843	.125	0, or trace.
100	200	100	80	860	.15	0, or trace.
100	205	100	80	865	.35	0, or trace.
100	215	100	80	860	1-1.5	Few.
100	225	100	80	800	2.6	Few.

From the results here shown, it is obvious that the optimum weight of sulphur for these quantities of water and lime, as determined by the volume of dilute spray and the amounts of waste and crystals, lies somewhere between 190 and 205.

The volume of diluted spray is highest at 205 pounds, but the rise in waste, accomplished by the appearance of slight quantities of free sulphur in the sediment, indicates under the conditions of the experiment at least that the optimum has been passed. The waste is smallest at 195 pounds, and from this one viewpoint it is best. But the waste is very slightly greater at 200 pounds, and from the viewpoint of freedom from crystals and waste, volume of spray, and simplicity of formula, 1-2-1, it is best. It is therefore recommended for general use in preparing concentrated solutions.

There is no serious objection, however, to any of the formulas with 180 to 205 pounds of sulphur, and where the material is to be used at once or if the purity of the lime is questionable, it may be desirable sometimes to approach the lower amounts.

OPTIMUM CONCENTRATION.

With the proper ratio of ingredients determined, the next question is what is the most efficient or optimum concentration. In the home product, the greatest density that is obtainable and permanent is not our goal. We wish rather to obtain the concentration which best utilizes the materials and is of storable density. The best utilization is here considered to be that which obtains the most tree-spray of uniform density from a given amount of sulphur and lime. A storable density is considered to be one which will permit a dilution of at least seven volumes and will stand at least 15 degrees of frost (17° F.) without freezing.

In answering the question of optimum concentration for a formula in the proportions of 100 lbs. lime to 200 lbs. sulphur, we tested concentrations at intervals of about five gallons for volumes varying from 128 gallons of concentrate down to 65 gallons. The method of trials, curve-plotting and deduction was also used here with results as shown in Table II.

TABLE II.
Approximate Results Obtainable from Different Concentrations.
(Using 100 lbs. Lime to 200 lbs. Sulphur.)

L-S. Lbs.	Water. Gal.	Boiling. Min.	Density at 60 Deg. F.	1.03 Spray. Gal.
100-200	128	20	1.183	780
100-200	125	25	1.193	825
100-200	120	30	1.223	896
100-200	116	35	1.233	904
100-200	115	36	1.234	900
100-200	112	40	1.238	892
100-200	110	43	1.240	861
100-200	105	50	1.243	853
100-200	100	56	1.247	825
100-200	95	68	1.258	800
100-200	80	70	1.266	771
100-200	80	85	1.269	718
100-200	75	94	1.276	690
100-200	70	104	1.284	663
100-200	65	118	1.293	636

From the results obtained it was apparent that the most efficient or optimum concentration differs with the demand. Under the conditions of the experiment, which were essentially those met in practice, the best utilization of materials occurred at 115 or 116 gallons of concentrate. This volume gave an average density of about 1.23, which permits a dilution of 1 to 7 2-3 for a 1.03 spray, and does not freeze above 15° F. It can be stored satisfactorily and is to be recommended where storage conditions are not exacting.

But where limited space and low temperatures are to be met,

umes may be best. For average qualities of both utilization and storage, 100 to 10-gallon volumes are best, as well as simplest, and are accordingly recommended in this paper for general conditions.

With the commercial product, however, where freight rates and the cost of packages must be considered, we believe a density not less than 1.30 to be preferable. It is entirely permanent if properly made and protected from the air, and its ease of dilution in obtaining the principal sprays further recommends it. We have here a product of 1.336 density (or about 36½° Baume), which was made on February 1, 1909, and which amply proves the permanence of solutions even stronger than the 1.30 density recommended. Other requirements that will be met by the best commercial firms are that their product shall contain *clear solution only and have nothing but lime, sulphur and water in its ingredients.*

When we reach the actual boiling of the materials, the procedure is not greatly different from that followed in the making of the ordinary dilute material. The utensils needed are a cooker, strainer measuring stick, and hydrometer. Cookers made of iron or wood are preferable. If steam is used it should be in closed coils, rather than live steam, at least in the later stages of the process, since it is desirable that the final volume be under control and be decreasing rather than increasing. The strainer should have not less than thirty meshes to the inch and 36 or 40 are preferable. The measuring stick is so marked as to enable one to make the necessary additions of water and get the final volume most readily. A hydrometer of the ordinary float type with a range from 1.000 to 1.35 is simple, and it may be fitted with both the specific gravity and Baume scales. Where but one scale is to be had, the former is preferable.

In making the concentrate, we have found it much more convenient, and at least equally effective, to add the dry sulphur to the slaking lime rather than adding it in the form of a paste. Care should be taken, however, to maintain a moist condition of the mass and to thoroughly mix it during the slaking, paying special attention to the breaking up of any lumps that may appear during the process of boiling.

TIME OF BOILING.

The material should be boiled until the sulphur granules are evidently dissolved. This fact is best determined by dipping and slowly pouring some of the material, under close observation. In many cases we have obtained as complete dissolving of the sulphur in less than 40 minutes of actual boiling as was obtained by any time up to 2½ hours. We know of no useful purpose to be served by continuing the boiling for any considerable length of time after solution has occurred, while on the other hand the amount of sulfites and sulfates, and therefore the sediment, is increased by unduly prolonged boiling. However, if a time of boiling were to be named, it is probable that a period of 40 minutes to one hour will be satisfactory, at least until the question can have further study.

The finished product, made by using 100 lbs. lime, 200 lbs. sulphur and 100 gals. of water, will have an average density somewhat above 1.24 (or about 28½° Baume). If the lime is good and the manipulation right, less than one per cent. of the product will fail to pass through a strainer as fine as 50 meshes to the inch at the

end of 48 hours or more. The material that passes through, however, is not all clear solution. Along with the latter there is formed a very fine sediment or sludge which even after settling for some days usually permeates the solution from a fifth to about a third of its depth. This sludge is made up largely of sulphites and sulphates of calcium, together with some free sulphur and lime, and whatever impurities the lime and sulphur contained which were not removed by the strainer. The magnesium, iron and aluminum, dirt, etc., are largely found in it. It is of doubtful value as a spray material but the difficulty of its economic removal and the apparent lack of objectionable mechanical qualities have led us to disregard it in the home preparation.

If it is desired to obtain only the clear solution, however, this may be done by letting the product settle for about a day, drawing off the clear portion and straining the remaining liquid and sludge through a moderately fine cloth placed inside of the strainer. The sludge may then be washed free of any further valuable materials by pouring through it the water to be used in making the next lot.

THE PROCESS OF DILUTING.

Having now our concentrate prepared, its proper dilution becomes a matter of importance. In the application of any concentrate, either home-made or commercial, it is essential that a definite method of dilution be followed. Two solutions may look exactly alike and yet differ widely in density, so that any accurate method must be based primarily on the density of the concentrate that is being diluted. Moreover, we believe that recommendations based on the density of diluted spray are preferable to those based on the number of dilutions even when accomplished by a statement of the concentrate's density.

Accurate dilution is very simple and easily accomplished with the aid of a hydrometer having the specific gravity scale. Sprays of any desired density may be obtained from any concentrate by simply getting the reading of the concentrate and dividing the decimal of this reading by the decimal of the spray desired. For example, if the reading of the concentrate is 1.27 (about 31° Baume), to get a spray of 1.03 density we divide the .27 by .03 and obtain 9, which is the number of dilutions required, and which of course is obtained by adding eight volumes of water. In this we are simply applying the general fact that the densities of solutions heavier than water vary inversely with the number of dilutions.

With Baume hydrometers, the dilutions are obtained indirectly, either by conversion into the Specific Gravity scale or by means of a special dilution table. In the later case, however, a table is likely to be needed for each density of spray desired.

USE OF SULPHUR SPRAYS.

The range of usefulness of sulphur sprays is unusually great. Their value as contact insecticides is already well established, though some of the egg-laying scales, such as the terrapin (*Eulecanium*) and sometimes the oyster-shell, are not as well controlled by the dormant applications as might be desired. The latter, however, was very easily killed with a 1.02 solution at hatching time which occurred on June 12 this year at the Pennsylvania Station. On the

other hand, our results with a similar strength against the apple aphid after it had reached the leaves were unsatisfactory, owing to the difficulty in wetting the insects even when completely immersed. From the work of Gillette and Taylor in Colorado, however, these insects can be controlled in the egg stage by a spray of about 1.04 density, applied before bud-opening.

But it is in the capacity of summer fungicides that lime-sulphur solutions are now most promising. This is chiefly because of the severe damage often resulting from the use of Bordeaux, which has created a strong demand for an efficient fungicide that is free from its injurious effects. Especially is such material desirable in controlling apple scab on varieties like Jonathan, Hubbardston, Gano and others whose fruit is often badly russeted by the Bordeaux spray. It is also very desirable in controlling the brown rot of stone fruits, whose tender foliage in many cases renders the use of Bordeaux impossible.

At the present time, the results of certain experiments indicate that lime-sulphur solutions properly diluted are likely to supply this need. It is not to be inferred, however, that they are to supersede Bordeaux entirely. The latter will undoubtedly remain our standard fungicide for many purposes, but with its limitations more sharply defined. And for special cases like those above, lime-sulphur solutions of *known ingredients* are now very promising.

DILUTIONS FOR DIFFERENT USES.

The proper dilutions for various purposes, especially for summer use have not yet been fully determined. Two questions are evidently involved: (1) the strengths that the foliage will stand; and (2) the strengths actually required to control the pests. With these questions answered, it would be easy to decide upon the best practical orchard strengths. In attempting to approximate these strengths at the present time, we conducted foliage tests with our material and also considered all definite, available results with similar sprays elsewhere.

In our tests the spray was applied at ten different strengths, ranging from 1.005 to 1.020, to the foliage and fruit of apple, cherry, grape, peach, European plum and Japanese plum. The results from six of these strengths, applied June 12, 1909, are shown in Table III. No addition of lime was made. The sticking qualities of the spray were excellent, since in spite of abundant rains the spray was very evident on the leaves for several weeks after application. In the table, whenever two figures are given in the estimate of damage, the lower one comes closest to my own opinion as to the true extent of the damage, but the higher figure is added in order to be entirely safe.

TABLE III.
Influence of Different Strengths of Lime-Sulphur on Foliage.

Number.	Density of Spray.	Per Cent. of Injury to Foliage. Estimated after Twelve Days.					
		Apple.	Cherry.	Grape.	European Plum.	Japanese Plum.	Peach.
1	1.006	0	0	0	5-10	5-10	10-15
2	1.009	0	0	0	10-15	10-15	10-15
3	1.012	5	—	0	10-20	40-45	25-30
4	1.015	15-20	—	0	10-20	50-60	40-45
5	1.018	5-10	5	5	20-30	80-85	40-50
6	1.000	10-12	5	5	-----	-----	50-60

As shown in the table, no injury of importance was caused to the first three fruits by any of the strengths used, excepting in No. 4, where a number of young apple leaves had been sprayed heavily on the under sides with a 1.015 solution. This showed a 15 per cent. to 20 per cent. reduction in foliage-efficiency.

In the case of the tenderer stone fruits, on the other hand, it will be observed that some leaf injury occurred even with the lowest strengths. And from our results it would appear that any protection of the fruit in the peach or plum is likely to be secured at some sacrifice in foliage. Our results indicate that solutions as strong as 1.009 may be used for a single spraying under normal weather conditions without exceeding a 15 per cent. reduction in foliage efficiency. If this sacrifice is considered not too great for the sake of the fruit, we believe that such a strength can be used. But from results obtained by Wallace at Cornell, with much weaker solutions it is probable that such strengths are not really needed to control brown rot, and until further work is done it may be best to consider a density of 1.005 as the maximum for peach and plum foliage, with a minimum for trial as low as 1.003 or possibly even 1.002.

But a striking thing in the effects of the spray was the fact that many thoroughly sprayed leaves escaped injury even at the higher densities, while many others showed considerable injury at the lowest strengths used. This condition was partly explainable on the basis of location of the spray on the leaf, the under surfaces proving much more vulnerable than the upper. But, undoubtedly, the main explanation is to be found in the fact that when applied heavily the spray collects in drops on the leaves (especially on the margins), and by evaporation is concentrated to injurious densities. Thus the *density of the spray as applied* may not be the controlling factor in foliage injury, but rather it is the *density attained on the leaf before evaporation is complete*. This depends on (1) the abundance of the application; (2) the density of the material applied; and (3) the size and location of the drops retained by the leaves. The first two factors are easily modified, within certain bounds, but the third is more difficult. If the spray could be kept

more evenly spread over the leaf surface, or if the larger accumulations of liquid could be removed before drying, the trouble would undoubtedly be greatly lessened.

In the case of the peach, where the injury is most severe the glabrous and slightly waxy foliage facilitates the collecting of spray into drops, which accounts for the prevalence of the "shot-hole" injury in the leaves. It also suggests the possibility of materially lessening the injury by jarring off the excess liquid shortly after spraying, since the pubescence on the fruit retains the spray needed. It is doubtful, however, whether this would prove commercially practicable, hence the need of further experiments and of caution among orchardists in dealing with these fruits.

From all definite results at present available, the following table of uses has been prepared:

TABLE IV.
Times and Strengths of Spray for Various Purposes.

Insect or Disease.	Spraying Times.	Densities of Spray.
San José scale, -----	Trees dormant, but best in fall or spring.	1.03 for regular annual control.
Oyster-shell scale, -----	At hatching time,	1.04 in bad cases, especially on old apple trees. 1.02.
Blister-mite, ----- Bilster-mite, Plant lice eggs, Peach leaf curl.	Just before buds open,	1.03 to 1.04. Latter strength for <i>aphis</i> eggs.
Apple and pear scab, Apple worm, add arsenical in 2 and 8.	(1) Blossoms beginning to show pink. (2) Within a week after petals fall. (3) About three weeks later.	1.01. May be varied by .002 or either way as results direct.
Cherry leaf spot,	Three sprayings, a month apart, beginning with signs of infection.	1.01, or slightly weaker.
Peach scab and brown rot of stone fruits. (Experimental as yet.)	(1) Three or four weeks after petals fall. (2) Half-way between (1) and (3). (3) Two weeks before fruit ripens.	1.003 to 1.005. May be varied .001 either way, as results direct. On peaches and plums, limited trials only, testing effect on foliage by applying to a few trees several days before regular applications.

While it is believed that the densities recommended in this table will generally prove efficient and safe under average eastern conditions, yet we have observed occasional injury from third and fourth applications when the earlier applications of the same strength of spray had proved entirely safe. Also in connection with the addition of arsenicals, we have found that the decomposition which follows the addition of lead arsenate and Paris green, is practically avoided by the use of arsenite of lime and that the burning

which usually accompanies the use of this material can be largely avoided with a slight modification of the Kedzie formula. This modification consists in reducing the sal soda to about one fourth the amount in the above formula, and then using the clear arsenite-of-soda solution in slaking an amount of lime sufficient to render the arsenic insoluble. By this method, we have succeeded in reducing the soluble arsenic to a mere trace,—.013 per cent. after 30 minutes agitation in water with air bubbling through it.

A number of important questions still remains for further study in connection with lime-sulphur solutions. We are not now certain as to just what the active agents are, nor how they act either in the killing of insects, fungi, or leaves. Neither are we yet satisfied with our knowledge of the minimum practical strengths for fungous and insect control.

APPENDIX.

Utensils.

The equipment needed for making and diluting concentrated lime-sulphur consists of a cooker, a measuring stick, a hydrometer, and a strainer.

The Cooker.—The cooking may be done either by fire directly, using an ordinary iron kettle, or by means of steam coils in vessels of either metal or wood, but preferably not with live steam because of its addition of water instead of reduction. Steam jacketed kettles, with mechanical agitators, are very satisfactory when steam is available.

It may be obtained from the Farmers' Supply Company, Philadelphia, or from Montgomery Ward and Company, Chicago, and the larger size preferable if much material is to be made.

This cooker is valuable because of its economy of fuel, its disposal of the smoke, and especially on account of the easy control of the fire it affords by means of the door and damper. It might be improved by the addition of a spigot in the bottom, reaching through the jacket and thus greatly facilitating the removal of finished products.

The Measuring Stick.—This is for use in determining the volume of water in the kettle at any time by means of its height. It is of importance in order to know when the material is boiled down far enough, and is also a convenience in adding the right amounts of water. It may be made by planing down a good lath to $\frac{3}{8}'' \times \frac{1}{8}''$ in cross-section and then accurately marking on it the heights reached in the kettle by 6, 8, 10, 12, etc., gallons of water. It is well to notch these marks with a fine saw, making those heights prominent that will be most used.

The Hydrometer.—This is an instrument very much like that used in testing acids in dairy work, but with a wider range, and is used in determining the density of the finished product preparatory to dilution. A convenient type of hydrometer for liquids heavier than water, is obtainable from George D. Feidt & Co., Philadelphia; or from Elmer & Amend, New York City; or Bausch & Lomb, Rochester, N. Y.

These instruments are made in two scales, the Specific Gravity and the Baume, both of which may be placed on the same instrument. Densities are expressed by the former in decimals and by the latter in degrees. The Baume scale is somewhat easier to read,

but the other is more convenient to use, inasmuch as the required dilutions can be obtained more directly from it. The range desirable is from 1.000 to 1.35 on the Specific Gravity scale or from 0 to 36° Baume. Such instruments have been put up according to these specifications, and may be obtained from the firms indicated above. They are simple in use and indispensable for accurate dilution of concentrated solutions.

The Strainer.—Any ordinary lime-sulphur strainer of about 30 meshes to the inch will be satisfactory for this work.

It may be used for either lime-sulphur or Bordeaux, and the central portion lifting out greatly facilitates the cleaning.

If the strainer is to be used for lime-sulphur only, tinned iron wire will be best for the screen. If, however, it is used for both Bordeaux mixture and lime-sulphur, brass wire is best. If kept properly cleaned immediately after use (which should be done with all metallic implements when lime-sulphur is used), it will last indefinitely. An improvement might be made by sloping the upper surface of its floor toward the spout, and its size may well be increased where large quantities of material are to be strained.

MATERIALS.

Sulphur and lime may usually be obtained locally in sufficient quantities and purity to meet the demands of concentrated solutions. In larger quantities, the sulphur may be obtained from: The Bergenport Sulphur Works, New York City; Powers-Weightman-Rosengarten Co., Philadelphia; or Thomsen Chemical Co., Baltimore. Prices vary from \$2.15 to \$2.60 per 100 lb., depending on the kind and quantities ordered. For best results the lime should in no case fall below 90 per cent. in purity and preferably not below 95 per cent.

Bringing together and applying the foregoing considerations, we have the following method of preparation:

HOW TO MAKE CONCENTRATED LIME-SULPHUR.

Materials:

50 lbs. best stone lime (90 to 95 per cent. (CaO).

100 lbs. sulphur (flour or powdered commercial 99½ per cent. pure).

50-55 gallons of water, at finish.

Directions.— Put 10 gallons of water in kettle and start fire. Place lime in kettle. After slaking is well started, add the dry sulphur and mix thoroughly, adding enough water to maintain a thin paste, which requires about five gallons. After the slaking and mixing is completed, add water to the height of 50 gallons on the measuring stick, bring to a boil and stir until the sulphury scum practically disappears. Then add water (preferably, but not necessarily, hot) to the 65-gallon height and boil again to 50 gallons, if storage space is limited. If it is not limited, a little more water should be added the third time and boiling stopped at about 55 gallons. The material should be kept well stirred, especially during the early stages of the process, and any lumps of sulphur or lime should be thoroughly broken up.

The total time of actual boiling should be about an hour, though a ten-minute variation either way is not objectionable providing the sulphur is evidently dissolved. This fact is best determined by dipping and slowly pouring some of the material. The amounts of water indicated above are ample for one hour's fairly vigorous boiling, with the finishing volumes as indicated. If it is not at the desired height at the close, it may be made so by more water or more boiling, (and either the amount of water in the third addition or the vigor of boiling can be so modified in later trials as to enable the total to be brought to the desired height approximately at the end of the hour.

The finished product may be immediately poured or strained into a barrel or settling tank or into the spray tank. The straining is merely a safe guard to prevent any possible clogging because of imperfect materials or failure to break lumps in the sulphur. When properly made, the amount of sediment left in the strainer is insignificant, being less than 1 per cent. as shown in Table I, and may be thrown away. To avoid any considerable loss of materials, however, the sediment in the strainer can be washed with part of the water used in making the next lot, simply pouring the water through the strainer into the kettle, and any lumps of sulphur discovered may be broken up and used again.

If the straining is not done, the whole product may be put into a settling tank or barrel and the clear liquid drawn off later as required. This process, however, is likely to lose efficient liquids in the sludge, as well as the fine sludge itself, which may be of value in several ways, and is of no apparent hindrance in the spraying.

The crust which forms on the finished material, is prevented by immediately covering the solution with a layer of oil about an eighth of an inch thick, and avoiding unnecessary exposure to air in the transfer from kettle to storage tank. An ordinary paraffin oil was very satisfactory in our work, but there is reason to believe that any other oil, not injurious to trees nor likely to take fire at boiling temperatures, may be used with equal success.

The crust may also be prevented by immediate storage in tight, closed vessels, filling them *completely*. But partially filled vessels are likely to develop some crust, upon continued exposure.

The finished product should be protected in storage from unduly low temperatures, though solutions of 1.28 density (32.1° after they are frozen. Less dense solutions freeze at higher temperatures, with recovery similar. Lower temperatures, however, Baums) do not freeze above 5° F., and usually recover completely are not frequent within six weeks or so of bud-opening, so that little difficulty is to be expected. In case some objectionable crystals form, they are easily strained out and re-dissolved by boiling in a little water, and may then be either returned to the solution or to some other one and the first diluted as usual without them.

COVER CROPS.

By PRESIDENT R. A. SMYTHE, *Benton Harbor, Mich.*

No one has a right to leave this earth in a worse condition than he finds it, and it should be his pride to say when Father Time calls, that the world has been made better by his having lived.

True! we are not all Edisons, Marconis, Burbanks, or many others that I could enumerate. But each man is responsible for the one life given him, and must answer for the development of his individual talents. I am not stating this from a sentimental or spiritual standpoint, but purely from the material and practical side: I wonder how many of us think of this as we go on year after year robbing the soil of everything we can, without returning anything to improve and rejuvenate it. Now, is this just to ourselves or to the generations that are to follow us? No, I think not. Why is it we hear of the deserted or abandoned farms in many of the eastern states, where farms with good houses, barns, outbuildings, and other improvements can be bought for almost a song. What is the reason? Some one must have made money enough on these same farms to have made these improvements, or they would not be there. But why are they abandoned? The land has become so impoverished by the continual cropping that it is worn out, and it is impossible to make a living on these farms. Can they be made again profitable? Yes! with proper cover crops and other fertilizers. Many people would prefer to go west and take virgin land, and start anew, but I would rather not; I would stay with the old farm, with all the memories and associations connected with it, and bring it back to a profitable investment. The trials and discomforts of going into a new western home do not look attractive to me. If you have been robbing your land year in and year out—stop it, and begin to put something back, grow something on this land which can be plowed under, and will improve it every year, and in a few years you will have your farm in a fine condition and will be with your friends and relatives.

In my few remarks I cannot enumerate the many ways in which you can improve your lands with fertilizers, manures, clover, peas, beans, and other legumes—saying nothing of cultivation, drainage, etc. I will only endeavor to impress upon you the value of growing cover crops on all cultivated orchard and vineyard lands. When I say "cover crops" I do not mean catch crops such as oats, rye, barley, wheat, corn and other things that are planted late in the season and grow until frost comes; these are only grown to stop the rapid growth of the tree or vine, and help ripen the wood before heavy freezing comes, also to help catch and hold the snow in the winter. A "cover crop" is one that is planted in the late summer and grows and lives through the winter, coming out in the spring, making a large growth to be plowed under. The different clovers

and vetches are the only cover crops of real value and as my experience has been more with vetch, I will confine my talk more closely to it.

From my own observation and what I can gather from all the State and United States bulletins there is nothing quite equal to the hairy vetch as a nitrogen gatherer and humus producer. The terms "Winter," "Hairy," and "Sand" Vetch are synonymous, but as the plant is covered with a fine hairy growth, it seems the term "Hairy Vetch" is the most appropriate. There are a score or more of different Vetches, but only two varieties of value are grown in the United States, and really only one of value in the colder climates. Hairy Vetch was first introduced into America from Europe in 1847. It is a native of western Asia; at first it was thought of little value and received little attention, but later it became the subject of many experiments at the different Experimental Stations, and by private parties, both in the north and south. It was not long before its real value was determined, and now it has been cultivated for more than 15 years, and is being more and more used. Ten years ago it was not heard of in our community, and five years ago I only know of one or two other sowing it besides myself, and this year I know one party that sold a car load of seed in my immediate neighborhood. I have been growing it five years, and from the greatly improved condition of the soil I am convinced it is of the greatest value as a cover crop and soil rejuvenator. My first experiment with it was on a high, sandy hill, where the sand blew badly, and where I found it difficult to get other cover crops to grow. I planted it about the middle of August; it did not make a large growth that fall—still, enough to hold the sand. It lived through the winter and came out in fine condition in the spring. By the time we were ready to turn it under there was a covering on the ground that was really something to see. After it was ploughed under, the soil spoke for itself, the color being several shades darker. We had set this piece of land with peach trees that spring before we plowed the vetch under. The trees made a splendid growth and were in fine condition until we had a very heavy frost in October, which killed many of the young trees; this was in the fall of 1906. The young trees that lived are now four years old and are in fine condition. I have been growing vetch every year on this same place. We have grown tomatoes and melons between the young peach trees and they have always been a profitable crop, except when injured by the dry weather. I always sow vetch seed when the melons and tomatoes are cultivated for the last time. We do this also on orchard and vineyard lands. When we planted melons and tomatoes on land where vetch had been plowed under, we found they did much better than on lands where we only fertilized with sheep and barnyard manures. I have found the greatest benefit in my grapes; where vetch has grown the vines made a larger growth and produced more fruit—also of a finer and better quality.

I believe that vetch is like all other leguminous crops, it grows better after the land has become inoculated. Every spring it makes an enormous growth, many of the vines being from seven to ten feet in length; it is a sight, and can be a terrible trial if you are delayed in plowing it under. I wish I could give you some idea of

the amount of green manure vetch will make, and am safe in saying many tons. My entire farm is covered with it this winter, and it never looked better. I have raised vetch where old trees are growing, and the trees are always much benefitted; the foliage becomes darker and the trees make a fine growth; others adjoining these (where no cover crop was grown) proved to me the value of vetch beyond a doubt.

A piece of land that had lain idle for a number of years and which I had been advised to leave undisturbed as it was of no apparent value, had been covered with a coarse grass, bitter sweet vine, weeds, etc., I cleared up the piece and sowed it to vetch, which grew beautifully, and now I have young peach trees growing there that are doing finely. The first season the vetch made growth enough that I pastured the cow on it during the fall months without seeming to injure the crop in the least.

The United States Department of Agriculture Bulletin No. 147 recommends planting vetch with winter wheat or rye if it is to be used for a forage crop. It also says vetch can be cut up and used for hay, afterward plowing under the stubble, claiming that this will be worth as much to the soil as plowing under the entire crop. I think this statement can hardly be true, as the green crop turned under must be of greater value in adding humus to the soil.

The Department of Agriculture recommends sowing from one to one and one-half bushels of vetch seed per acre, but I find 40 lbs. a great plenty and 30 lbs. if sown with wheat or rye. The seed is expensive, selling from seven to eight cents per lb. and weighs about 60 lbs. to the bushel. The seed is very hard and a little smaller than sweet pea, which it resembles. It can be planted deep, which is a decided advantage over clover as it does not kill out in case of dry weather. I have always sown the seed broadcast and cultivated or disked it in. Vetch re-seeds itself, and the seed may lie dormant in the ground for several seasons before springing into life again, for this reason it is not advisable to rotate vetch on grain lands.

I am indebted to a friend for the following information which bears witness to what vetch can do.

On the 17th of May, 1905, he measured a square yard each of vetch,—mammoth, medium, and crimson clover,—he dug, cleaned, and weighed each sample with the following result: the vetch weighed 12 lbs.; mammoth clover 11 lbs.; medium clover 10 lbs.; and

	Dry weight. Lbs.	Ash. Lbs.	Nitrogen. Lbs.	Phosphoric Acid. Lbs.	Potash. Lbs.
Vetch,	8,078	1,206.5	357.64	86.88	106.18
Mammoth clover,	6,287	1,073.8	177.81	49.07	78.57
Medium clover,	5,900	-----	148.04	27.75	50.59
Crimson clover,	1,446.68	265.77	51.6	5.91	15.33

The Department of Agriculture of Washington states that a crop of vetch plowed under is worth \$16.00 to \$45.00 of commercial fertilizer per acre. Of course it does not have the immediate effect of a fertilizer, but its fertilizing properties are felt for the entire season and much longer.

It seems to me, all things considered, there is nothing the fruit growers can better invest his money in than vetch, and I believe it will play a great part in rejuvenating our orchards and vineyards and bringing them into greater productiveness.

RECENT DEVELOPMENT IN A CHEMICAL STUDY OF LIME-SULPHUR WASH.

By PROF. H. A. SURFACE, *Harrisburg, Pa.*

I should have preferred to entitle my talk "Some New Facts," or "Some Facts That Have Recently Been Developed in the Lime-sulphur Wash." I am not a chemist but I have had a special chemist working on the subject in my office. I am gratified to know that Prof. Stewart is working so well along the same line. Dr. Van Slyke, of the State of New York, and Prof. Parrott, of the Experiment Station at Geneva, are all working along the same line, and reaching the same conclusions.

We stand at the beginning of a new era in regard to spraying, because of certain facts that are becoming established. These are:

First: Color of the lime-sulphur. Most of the facts are already in print in the November Bulletin from our office, but this has not yet been mailed, having been delayed through some error on the part of the State Printer. The copies have just been received at our office, and will at once be sent out.

Briefly, we conducted a series of experiments, making one solution of calcium oxide, a pure grade of lime, without magnesium in it. We had a double strength solution. In another there was about 31 per cent. of magnesium oxide—about one-third magnesia

and in it we obtained the red color of the liquid as in the former. Then we made another solution, in which iron was used with the lime, and that also had the red color, but in the sediment we had a different color. This was dark muddy green. Then we made another solution, in which manganese was used. In that also we had a red color of the liquid, and a dark color of the sediment, and we came to the conclusion that color can be no criterion as to the length of time of boiling. The liquid will always be a wine red. If you mix the manganese or iron with the lime that way, you will produce a dark olive green. If there is no union, it will still be red. So the color cannot be depended on to indicate the length of time of boiling. It does not depend upon the calcium oxide, notwithstanding what has been published in bulletins heretofore. I said in a bulletin some time ago that magnesium oxide would give it the dark color. That is not true; is it the iron or magnesia that gives it the dark color. The dark colored materials, which give it the dark color, are contained in the sediment, which is of no value to the spray material. The real value is in this red colored material.

The second point is the crystallization of the lime-sulphur wash. The home-made boiled lime-sulphur wash which is regarded as standard, consists of:

17 pounds sulphur.
22 pounds lime,
50 gallons water.

The exact proportion is not so necessary, but the more lime you have, and the more water you have, and more you form of a low sulphide, known as the oxide and the common sulphides. If you can keep that out, you form the poly sulphides.

Prof. Cordley, of Oregon, who has been experimenting along the same line as Prof. Stewart, writes in the "American Agriculturist" for January, 1908, for the first, that it is now possible to produce the lime-sulphur solution at home in concentrated and storable form. I recommend:

Sulphur, 125 pounds,
Lime, 60 pounds,
Water, 50 gallons.

At the conclusion of the boiling, it is to be up to 50 gallons. If some boils away, add more, and, as Prof. Stewart says, boil until the sulphur dissolves, which is 45 to 55 minutes. Flowers of sulphur will dissolve a little more quickly than flour of sulphur, but

crystallizing like the concentrate. It does not have to be boiled with 50 gallons of water, but can be diluted to 50 gallons after boiling.

The 17-22-50 must be diluted to one-third if you want to keep it. If you want to keep it concentrated you can make it in solution, such as Prof. Stewart advocates. It is low sulphides in the solution which crystallize. To make it storable we must reduce the amount of water and lime in which it is boiled.

Third: Amount of lime needed, and composition of lime. Twice as much sulphur as lime can well be used. We made some investigations running as high as 15 per cent. or more, of magnesium oxide, and got a solution which was not only as strong chemically, but which stood the hydrometer test as well. You can get just as strong a lime-sulphur solution from a lime that has some magnesium or sodium in it, as you can from a pure quality of lime. If you have any sediment left after boiling it must be strained out.

Air-slacked lime, if air-slacked quite recently, is all right; but if of long slackening it will not do. If you wish to slack it for horticultural purposes, slack it immediately and keep water over it. One good friend in New Jersey uses it in this way, in a barrel standing down in the ground in a swamp, so the water stands always over it. He dips out three times as much of the lime paste as of the fresh burned lime.

The next point is, the need of a hydrometer. The time has come to test for specific gravity, and to do this a hydrometer is necessary. You will understand that the hydrometer will tell you only the strength of the materials. If sugar, or salt, or alum, is added, the hydrometer will not tell that. It can only give the specific gravity. You can have a chemical analysis made to find the presence of any other substance, or you can have the manufacturer give his guarantee that there is nothing but lime and sulphur in it.

THE COMMERCIAL LIME-SULPHUR SOLUTIONS.

I need hardly tell you that all lime-sulphur is not of the same grade. One firm will make one grade, and another, another grade. You cannot tell whether it is efficient or not by looking at it. Only the test will show that. We have analyzed the different brands of lime-sulphur wash, and taken their specific gravity; compared with the home-boiled, the amount of dilution would be as follows:

The 17-22-50 has about 14 pounds of sulphur with a 50 gallon barrel of the dilute material. The commercial brands generally recommend 1-11, 1-10, 1-9, 1-8, but we find from the analyses that those samples the following brands which we have analyzed should be diluted as I give them:

Snavely's Brand,	.....	1-4
Lion Brand,	.....	1-6
Niagara (clear),	.....	1-7
Niagara (dark),	.....	1-7
Niagara, later sample,	.....	1-10
Orchard Brand,	.....	1-8 plus
Rex Brand,	.....	1-10
Snow Brand,	.....	1-6

Grasselli's,	1-9
Scaline,	1-10
Cocklin's Scale-clean,	1-10
Sherman-Williams,	1-10

Now, there is a new material on the market called "Never Scale." It is in the form of a powder, to be boiled five minutes in water. We boiled it in the proportion of one-half pound to one gallon; we found this would not do, so we boiled it, three-quarters of a pound to the gallon, which gave us about the strength the home-boiled formula does, so the point is that "Never Scale" would be efficient as a scale-cide if boiled three-quarters of a pound to a gallon of water.

THE EFFECTS OF CARBONIC ACID GAS ON LIME-SULPHUR.

I feel that I should say something about the effect of carbonic acid gas on the lime-sulphur spray. We made a number of tests with it, and found that the sulphur in the solution was precipitated by the action of the gas, and as the sulphur was thrown down as a free sulphur, it became less efficient as a spray. We had 90 pounds of pressure in the first experiment, and the material was warm. We had the home-boiled, 17-22-50 and found that 37 per cent. of the sulphur was lost in the first five minutes; at the end of the next five minutes 43 per cent. had been lost, and at the end of the third five minutes, 53 per cent. had been thrown out. The next experiment, we had the cold, 17-22-50 standard, without sediment, and with agitation, and pressure of 90 pounds per square inch. At the end of the first five minutes, we lost less than 1 per cent.; the next five minutes, 1 per cent.; at the end of twenty-five minutes 8 per cent.; and at the end of 40 minutes, 20 per cent. We tried again with a solution with a sediment, and kept it agitated. At the end of the first five minutes we had lost 14 per cent.; at the end of the second five minutes, 16 per cent.; and at the end of thirty minutes, 19 per cent. This showed conclusively that carbonic acid gas had a deleterious effect upon it.

I know where there have been some (only a very few) terrific failures with the lime-sulphur wash; some were due to the character of the spray (being too dilute), and some of them to the faulty method of applying (not thorough); some of them to the carbonic acid gas spraying machine.

EXPERIENCE WITH PEACHES.

By JOHN F. BOYER, Middleburg, Pa.

I have been a member of this society for twenty-two years and always look forward to this meeting as a great school for the horticulturist, because here I always meet the best of friends. I am sure I owe much credit to the members of this society for the suc-

cess I have achieved as a fruit grower, my occupation for the last twenty-six years, having at one time forty-four thousand peach trees in cultivation, besides apples, cherries, plums, pears and about ten acres of small fruit. I will endeavor to give briefly my method of peach culture in such a way as my experience dictates, with the understanding that I believe that the peach is the most critical crop man can undertake to produce.

I was never the owner of an ideal peach orchard because I had to own the one that produced crops the proceeds of which paid all the bills and allowed a certain per cent. towards the support of my family. Some growers boast of never having a failure of a crop. I can say that myself but some of the crops were so small that I had to throw my note into bank to get sufficient capital to carry on my business until another crop was marketed.

It is almost necessary for a peach grower to sleep with one eye open in order to keep abreast of modern requirements. Providence is a great factor in all lines of production but man must take a hand in it and assist nature in every possible way. Providential fruit culture is a thing of the past.

What are the requirements of a successful peach culturist today? These are many but chief among all is the man himself. Unless he has an iron constitution so he can stand reverses he will not keep courage enough to make a success of the business. This may explain why the peach belt is traveling from place to place.

Having a suitable man, next of importance is the soil and location. I will now describe my own location and soil. I am located fourteen miles west of Sunbury, Pennsylvania, on a ridge or range or mountains between the Juniata and Middlecreek valleys. These hills are underlaid with bird-eye and black iron ore. Some places this black ore crops out, this is known as iron stone or iron stone gravel.

These hills have an elevation of from about eight to twelve hundred feet above sea level. This gives us a splendid air drainage for the production of all kinds of fruit and peaches grow to perfection in this soil if proper treatment is given them. I always try and buy the best trees I can secure and prefer a stocky three or four foot tree.

I plow the ground in the fall, or early spring will do; prepare the ground as for a crop of corn and furrow out the desired distance the trees are to be set, which with me is from fifteen to sixteen feet apart each way, depending on the slope of the ground.

I might say here that I do not grow my peaches on trees; I grow them on bushes. I never in all my twenty-six years experience owned or used a step ladder to pick peaches. We are too busy when fruit is ripe to fool with step ladders.

Having the ground ready to set the trees, I take them from the box, with the inspection certificate on the outside and the trees and frequently the yellows and San José scale on the inside. The holes are dug deep enough to admit the trees to be planted about two inches deeper than they stood in the nursery. The holes should also be large enough to admit placing the roots in the natural position after all broken and bruised parts are cut out.

After the trees are set the branched top is cut away and leaves only a cane from eight to twelve inches high being governed some-

what by the set of buds which nature has put there to form the top.

Potatoes are grown the two first seasons, after that clean and thorough cultivation is given the trees as long as I consider the orchard profitable. I am frequently asked the question what crop could profitably be grown in a peach orchard after the third year, and the only answer I know to that question is, "A peach crop."

Each spring about one-half of the previous year's growth is cut away. Judgment must be exercised, however, so a well-balanced spreading top is secured. Always bear in mind that the peach tree is unlike the apple, it has no fruit spurs but bears its fruit on the previous year's growth; this annual pruning keeps a succession of new wood. The idea of stopping cultivation about the first of July is all a dream. I keep the cultivators going as long as it does not brush off too many peaches. I generally have a crop just as heavy as the other fellow has.

Enemies to peach trees are almost numberless and the only safe way to get rid of the borers is to dig them out and break their necks. The disease among peach trees known as the yellows proves even worse than the scale. The only remedy I know to hold this disease in check is to dig the diseased trees out and burn them as soon as discovered. San José scale; this pest can now be held in check by spraying although spraying is still an experiment to a very great extent. How glad we can be that lime and sulphur has been discovered, as before this was known we were told by the theorists that the only way to get rid of scale was to buy tents something similar to that of Barnum and Bailey's and fumigate with gas.

During the winter of 1904, I had the opportunity to visit the peach belt down in Georgia, and while I looked over thousands of acres in peach trees around Fort Valley, I was very much surprised. I found there the growers with the small acreage were really making the most money while some of the largest growers were the owners of orchards that did not pay. Before I went there I had an idea the "big fish" would eat the "little" but after that visit I felt sure the "little fish" would eat the "big one."

I notice our worthy President and Secretary are appealing to the fruit growers of Pennsylvania. Let us as members of this Association appreciate their extra efforts and become more active, not just here in the meeting. Is it possible that a State like Pennsylvania with all her resources must have so few members in the State Association. Travel north, south, east or west, over and through the State and you will find the best of markets. Thousands upon thousands of people depend upon the products of our Pennsylvania farms. Only a glance at the markets will reveal the fact that two-thirds of the products are shipped in from other states, all of which, except tropical products, could and should be produced in our own State. Eyes and ears have we but it seems to me sometimes that we hear not neither do we see.

Well we Americans are a funny class of people anyhow. It seems to me sometimes that we are pretty much like sheep; where one goes we all want to go. You can all recollect the time we Americans all wanted to go to Klondyke to dig gold, then came the German hare craze, then the Angora goat, then crimson clover, then ginseng, now alfalfa, and the price is way up on skunk hides. Next we will all want to grow skunks.

Knowing the requirements of a successful fruit grower as I do, Mr. Chairman, I fully realize that it is a waste of time to go into detail about peach culture to a class of men so bright and well informed as these here assembled. I further believe these men who compose the State Horticultural Association are the class of men who kept up an inspiration by demonstrating through their respective community to those who surround them and I further believe that were it not for these men Pennsylvania would have lost her fruit interests commercially before now.

LIFE HABITS AND HISTORY OF THE BROWN TAIL MOTH.

By J. S. BRIGGS, Norristown, Pa.

The habit and life history of this insect should be well-known throughout Europe, for a period of one hundred years, laws have been in operation relative to its suppression. Articles concerning it have appeared in the papers and other publications of that country for nearly two hundred years.

Through international commerce, we are exposed, so to speak, to the introduction of many of the pests of foreign countries. For example, the Hessian fly, San José scale, and the Codling moth are now in our midst through this means, and, under our climatic conditions, multiply rapidly, and are inflicting great damage to our agricultural products. The Cotton Boll Weevil is another pest which came to us in our southern borders in 1894; and, from latest statistics, twenty millions of dollars are spent every year to keep it under control. I am frequently asked concerning the San José scale, "When are we likely to accomplish its extermination?" and my answer has been "Never!" The word "extermination" is too strong a term to use in such cases. Extermination is impossible; we must be satisfied to control it; and so with other similar pests.

Our great trouble has been that these pests get into our country unnoticed, and are not discovered until some damage is done by them, and our attention is called to them. This has been the experience in each of the cases mentioned, and, I presume, why I am permitted to talk about this much-dreaded Brown Tail moth at this time is to help us to a better knowledge of its external appearance in its different phases of life; to be able to recognize it, and to know how to destroy it.

May I here state that our Prof. Surface, with forethought, and with knowledge of our experience in the past, wisely concluded that one ounce of prevention was much better than a pound of cure, and gave the alarm about a year ago. From the February Bulletin of 1909, allow me to quote his words: "At the present time we are facing more grave danger of the introduction of the most destructive and objectionable pest in Pennsylvania than we have ever

before experienced. It appears that the Brown Tail moth, which is so destructive in Europe, and against which laws have been operative for nearly one hundred years, has suddenly occurred in immense numbers on nursery stock, rose bushes, and other plants sent from Europe to America. Our State law is adequate to take care of this just as far as legal provision can be made, but knowledge of the subject by all persons interested is necessary for that co-operation that is essential to secure proper results in preventing loss by these pests.

"After they are once introduced into this, State, it will cost several times as much to exterminate them as to keep them out." (He will pardon me, I hope, for suggesting the word "control" instead of "exterminate.")

Immediately following this statement, the call was made for a number of men in his employ to proceed at once to inspect consignments of foreign goods which had reached our borders. This inspection captured (I think this is the right word to use in this case) current report says, about one hundred nests of Brown Tail moths. Pardon me for mentioning the work of a department of which I am a member. I personally, deserve no credit for any of this work. It was a case of "Betty and I killed the bear." I was not around when these moths were captured. It is due the department, however, that the public should know it, and it is also due the public that they should know what is being done for their good.

It was during the spring of 1897 that certain residents of Somerville and Cambridge, Massachusetts, discovered a strange caterpillar upon the unfolded leaves of their pear trees, and, upon closer investigation and inquiry, it was determined by Messrs Fernald and Kirkland, reliable entomologists of that State, that the new enemy was that of a well-known species of Europe.

Still further investigation followed, and the fact became settled that this moth had been in Massachusetts since 1890, and from that time had been spreading slowly into unoccupied territory.

From the summer of 1897 to the autumn of 1899, quite a vigorous effort was made to repel the spread of this insect. The State appropriation had been limited to \$6,000, and at the end of this time became exhausted. For five years nothing was done to prevent its spread, save that of the work done by the individual property holders. During this latter period it spread into all of the New England States save Connecticut. In this State it was not found at this time. Dr. Kirkland tells us that during the first three years of this latter period it added about six hundred square miles of territory, in which it did much damage.

The eggs are described as being about 1-30 of an inch in diameter and hatch in from fifteen to twenty days. In form they are more or less globular, and of a light yellow color. The masses of eggs are about two-thirds of an inch long and about a quarter of an inch wide, and are laid on the under side of the leaves about the middle of July in this latitude. The masses themselves are rather brown in color, and are covered with hair and many of them contain three hundred eggs.

The full grown caterpillar is about two inches long and of a reddish brown color, with a broken white stripe in each side, and with two red dots on the back, near the end. It is covered with

tubercles bearing long barbed hairs. The tubercles along the back and sides are covered with short brown hairs in addition to the larger ones. These give the tubercles, when magnified, an appearance like velvet. The head of the caterpillar is pale brown with darker spots.

The very young caterpillar is of a very dark color, with reddish brown hairs, and the head is jet black; on the middle line of the ninth and tenth segments is an orange or reddish tubercle, which may be withdrawn into the body. After the second spring moulting, the brown tufts on the back become less prominent, and the white broken line becomes more noticeable, giving the appearance of the full grown caterpillar.

The full grown caterpillar or larva spins a cocoon of gray silk which is so thin that the caterpillar can be seen through it, and within this cocoon it is transferred into the pupa. It is about five-eights of an inch long, dark brown in color, with a conical spine at the end of the abdomen, bearing a cluster of minute hooks at the end. Smooth, yellowish brown hairs are found scattered over the abdomen, and in the top of the thorax. The cocoons are usually spun at the tips of the branches, and sometimes a dozen or more larvae will spin a common web, within which each individual forms its own and transforms to a pupa. The cocoons are sometimes found under fences, and under cornices of houses.

The adult, or moth, is pure white, the end of the abdomen being slightly brown, and at the tip of the abdomen, more conspicuously than that of the female, is a tuft of brown hair, almost globular in form, whence the name. There can be no mistake as to the identity, since it is the only insect in this country to which the description I have given applies. You will observe that the female is a little larger than the male.

The brown tail moth feeds upon all kinds of foliage; that of fruit trees as well as that of the ornamental shrubbery and forest trees, and as a dangerous and destructive insect is among the first in rank.

They begin to look for the moth in Massachusetts about the 1st of July in each year. (We hope we shall not need to look for them in Pennsylvania, expecting to find them). As twilight approaches, they begin to fly. Their number gradually increases each hour, until at midnight, they seem fairly to swarm.

The moths seem to be attracted by the light, for they are seen in great number near electric lights at night, and it is at this time, and at this period in life that they spread so rapidly. The prevailing winds had much to do with their spread into the States of Maine, New Hampshire and Vermont. They have been discovered on the sides of vessels at sea, and on railway trains coming from infested districts. They are also carried from infested districts, in the caterpillar state, on one's clothing, and ordinary road conveyances. Within a few days after they begin to fly they deposit their eggs upon the under side of the leaves. About a month later, the eggs are hatched, and the young caterpillars begin to feed upon the upper side of the leaf, first upon the one bearing the egg mass, and later reach out to the other leaves, but return at night to the leaf from which they were hatched. When first hatched they are about one-tenth of an inch long. They shed their first skin within a week from

the time they were hatched, and are then about one-fifth of an inch long. Late in autumn, and generally within their winter webs, they shed their second skin.

Usually in September they begin to spin their winter webs, drawing a number of leaves together with silk. In each of these many pass the winter. These nests are from five to six inches in length, and many times contain more than two hundred caterpillars.

They have a small opening in their webs, through which they pass in and out until cold weather; then the opening is closed, and they remain within during the winter. At this time they are about one-quarter grown.

There can be no mistake as to the identity of these webs. Any web of the character and description mentioned, and found during the winter, containing young caterpillars, is the web of the brown-tail moth. Webs of other insects found during the winter are always empty at that time.

In the spring of the year, as the buds begin to appear upon the fruit trees, the young caterpillars come out from their winter homes. They have not increased in size during their long fast, and, naturally they have excellent appetites. It is at this time in their lives that they do so much damage. Buds, blossoms, and later, the foliage, are consumed.

As the caterpillars fill themselves with the buds and leaves in the spring and summer season, so they correspondingly develop and grow and soon reach full size, when they begin to spin their cocoons. This is begun, usually, about the middle of June, and, as I have stated, in these cocoons the transformation to the pupa takes place. In this State they remain for a period of about twenty days, when the cycle of life is complete.

The hairs of the caterpillar of the brown tail moth are finely barbed, and when they come in contact with the human flesh, they reach the pores of the skin, and being quite brittle, sometimes break off, leaving a part under the surface, causing a very unpleasant itching, and in a number of recorded cases, persons have been severely poisoned. It is not necessary that the person himself come in contact with the caterpillar, for at the times when the caterpillar changes his skin, and at the time of the spinning of the cocoon, many of these hairs are loosened, and are carried about by the wind. In the summer of 1906 at North Saugus, Mass., in the parasite laboratory, two of the assistants who were obliged to handle a large number of these wintering nests, were poisoned to such an extent that

Menthol,	.....	10 grains.
Oxide of zinc,	.....	2 drams.
Lime water,	.....	8 oz.
Carbolic acid,	.....	10 drops.

for external application only.

Unfortunately, the brown tail moth has but few natural enemies; we have come to know, however, that some of our birds assist in checking the spread of this most destructive insect.

The Cuckoo and the Baltimore Oriole do their part in this great work, and the much despised Blue Jay contributes no small share in this service. These feed upon the insect in its caterpillar stage, while many other birds feed upon it in its moth stage.

Dr. Kirkland tells us that at one time, when the moths were emerging in great numbers from the sides of the fences, he observed whole flocks of English Sparrows following after them and devouring them.

Bats and toads come in for a share of this work, as the moths fly about electric lights and fall to the ground.

We wish now to consider some of the remedies for the destruction of this insect. Our best authorities have come to the conclusion that the most effective means of controlling the brown tail moth is the collection and immediate destruction of the winter nests, which are found after the leaves have fallen—we will say from October to April—in about this latitude. Each nest will contain two hundred or more caterpillars, and as we have stated, about one-quarter grown.

In Massachusetts some men make a business of collecting and destroying these nests, and are equipped with long ladders, climbing irons, etc., adapted for that purpose.

After the leaves come out in the spring, the caterpillars, leave their nests, and at once commence devouring the foliage, and then our only remedy is to spray with some arsenate preparation, usually arsenate of lead in the proportion of two pounds to fifty gallons of water, when they are young; when they are older, a stronger mixture may be necessary, and we might double the proportion of arsenate of lead when they are fully grown.

One picture shows typical hair covered egg masses of brown tail moth laid in July, 1899, on trees sprayed May 18th, 1899, with arsenate of lead. So well did the poison adhere to the leaves that the caterpillars died as fast as they were hatched. From a photograph taken at Malden, Mass., Sept. 30, 1899.

You will notice that the spraying was done in May, the eggs laid in July, and the photographs taken in September. And we are told that the work was a success.

Paris green is sometimes used for this purpose, but it should not be used stronger than one pound to one hundred gallons of water, for fear of burning the foliage.

It is said that in some localities the services of school children have been secured by the payment of a bounty for each nest obtained, and much good has been accomplished in this way.

In Massachusetts they have a law which declares that the Gypsy and Brown Tail moths are public nuisances, and suppression is required. A superintendent is appointed by the Governor,

with the power of appointing agents and assistants in the work of suppressing these moths. Cities and towns, under the advice of this superintendent, are required, under penalty for neglect, to destroy the eggs, pupae and nests of the moths within their limits. In cases of failure to do this, the superintendent shall cause their destruction, and shall assess upon such properties the cost of so doing, to an amount not exceeding one-half of one per cent. of the assessed valuation of such land or properties, provision, however, being made for those who because of age or poverty are unable to pay the expense. To meet this requirement, during the years 1905, 1906 and 1907, the State appropriated \$300,000, and for the purpose of experimenting, an additional sum of \$10,000 for each of these years, making a total of \$330,000 for this period. Any one who resisted, or in any way sought to obstruct the work of an employe lawfully engaged under this law, was subject to a heavy penalty, regardless on whose premises the employe might be at work.

With your permission, I will close by reading an article published in the Philadelphia Public Ledger in July last:

"New England is again at war. Her historic hills are ringing with the sounds of combat, and her verdant valleys are volleying defiance to a common enemy. But 'tis no hated redcoat that is charging the Eastern States in a taxicab to-day; no merciless minion of a plump potentate presents his scarlet uniform for the farmer's boys to pluck. The foe is dressed in brown velvet; he hides in the trees; is numbered in countless millions; is more voracious than the hungriest Hessian ever hired by King George, and the damage he has inflicted since he arrived on our shores is estimated to be ten times as much as all the wreck of fire and flood since the colonies were young.

"The Brown Tail moth is the invader that the farmers and scientific men of New England are battling, and, although the State of Massachusetts has alone spent more than \$7,000,000 in the war against him and his terrible brother, the Gypsy moth, the human forces have thus far met nothing but defeat. Like the Gypsy, the Brown Tail moth works his havoc in the caterpillar state. Each mother moth lays about three hundred eggs, and each caterpillar converts several hundred leaves into skeletons in the course of a season. Nor are they at all particular what they eat; buds, blossoms and leaves, taste equally good to them."

PEACHES.

hard to start peach trees where old peach trees have previously grown, and would not advise resetting in such places until the land has been cultivated for several seasons, and corn crops grown on them.

See that you get good trees. I am sure that much of the failure we have had in recent years in Michigan in starting trees has come from the nursery stock we have been getting; I know of cases where the little trees have developed "Yellows" the first season after they were set. The disease must have been either in the seed or bud. It is time we were making the nurserymen liable for the stock they are selling. Now, possibly you have in this country good nursery stock, but most all we have at our command comes from the eastern states. At our annual meeting at South Haven we had a discussion about the pit taken from a tree with the "Yellows," whether it will produce a tree or not. We have not heard any one say that it will not, but I think the chances are that it will not produce a healthy tree. Like produces like. If you grow your own trees, be sure to have good pits. In Tennessee, where most of the pits are gotten, they have the Yellows worse than any other place in the United States—so I am told.

The selection of buds is just as essential as the seed. If you have a good vigorous tree, that is the tree from which to take your buds. That is not what a nurseryman does; he takes buds from the nursery row and as these trees are not bearing, he don't know what he is getting.

The "Little Peach" and "Yellows" we have,—I trust you do not have them here. Our Secretary, Mr. Bassett, told your President, Mr. Hiester, that we have eradicated the "Little Peach" and "Yellows," but we have also eradicated the orchards in doing so. I am not satisfied with this, and still hope we will discover some way of overcoming these diseases without destroying our trees. Taking out the diseased trees is the only safe plan to follow.

I am sorry to come to Pennsylvania and learn that the Pennsylvania growers are packing the fruit as badly as we are in Michigan. Out there we find the top and bottom of the barrel all right, but the middle is not up to them. I am sorry to talk about this, but I gave you credit of not doing this here. In Canada, under the Marks law, they have to pack and grade the fruit, as it is inspected; so it is up to every man to see that his fruit is standard grade; also he has to put his name on the package. I would like to go a little farther in the United States and state the fixed size of the package and make it uniform everywhere. We in Michigan have so many different sizes of bushel baskets,—I don't want to sell a full bushel for the same price that some other man is selling a snide bushel.

I don't think I will say much about our picking and packing. Most of our best fruits are packed in what is known as the "six basket Climax crate," which holds about three-fifths of a bushel. I find we make more money in this way than in any other package until it comes to the canning season. Then the demand is for the bushel.

I was very much interested in the varieties mentioned this afternoon. With most of them I am not familiar, except with the Elberta. This is our standard peach for shipping. The Elberta is a

good shipper, but in my opinion, there is nothing quite equal to the Engle Mammoth. I never eat an Elberta when I can get anything else.

As to markets; we have a local market, and a man generally drives into town with his fruit. The buyer comes out, looks at the fruit and says to the man, "What are you offered for your peaches to-day?" The man says, "That is none of your business; what are you willing to pay?" The buyer don't seem able to discriminate, and the man who raises fine fruit gets no more for it than for ordinary fruit. I went out into the market this fall with Concord grapes, which are usually put up in eight pound baskets, and a man asked me "What is your price?" I named it, and he said, "I won't give it." I said, "But there is not a basket here that does not contain eight pounds." He agreed that was true, but it did not make any difference to him whether it held 6 pounds or 8 pounds, and said, "I won't pay any more." So we may pick and pack our fruit all right, but when we get to market we fall down. We must study the market more. We have to ship to Chicago, and there the commission man takes out his commission, freight and cartage. It does not leave the grower a great deal. I think that where the Hood River people make such a success is by having their own market to depend on, and one man to look after their interests. We tried the packing house system, but it was not satisfactory; too many of the farmers were not honest and most of the fruit that came in had to be handled over again. In one case, out of four hundred bushels that came in, we sent one hundred and eight bushels to the cider mill. The man who was only picking and selling the best could not afford to co-operate with the man who brings in poor stuff. If we had a uniform standard of measure and grade it would be money in our pockets.

I am glad we have the San José scale. It forces out of business the men who did not attend to their orchards, and we are glad of it. Since we are compelled to spray our trees, our orchards are looked after better, and consequently pay us better.

APPLE VARIETIES; OLD ONES THAT ARE GOOD AND NEW ONES THAT SEEM PROMISING.

By H. P. GOULD, U. S. Department of Agriculture, Washington, D. C.

It is not without some feeling of embarrassment that I come before you at this time to talk about apple varieties. You have your own variety experts like Dr. Funk, your worthy President, Mr. Hiester and others, beside of whom I feel like a pigmy from the variety standpoint. Furthermore, the great number of varieties which are grown in your state that are doubtless of value and concerning which but very little is known, serves still more to complicate matters. If I am able to say anything that will interest



FIG. 2.—BUSHEL HAMPERS.
A Package much used in Shipping Summer Apples.

you along the line of my subject,—which by the way was chosen for me—it will be because of the somewhat wide range of conditions under which I have been able to study some of the varieties that I shall mention. If later on, I am permitted to introduce to you some strangers among varieties which give promise of meriting your intimate acquaintance, it will be a pleasure to do so.

The problem of varieties is an old problem and it is a great one. I fancy it will always remain a great one. As long as there are varying conditions under which fruit is grown and as long as there are different tastes to suit and different purposes for which it is desired, the problem will continue to be an unsettled one.

When, in retrospection, we consider the varieties of apples that have contributed to our pomological history, and contrast them with the varieties that we think of to-day as new sorts, we cannot help asking the question "What real advancement has been made from the variety standpoint?" and "Whither are we bound in the line of varietal progress?"

Surely the apple must have been an enticing thing, which in the Garden of Eden, caused the trouble that has ever since been the heritage of the human race. We would like to know the variety. The good people down in Albemarle county, Virginia, are quite sure it was Yellow Newtown (Albemarle Pippin). And the apples which in ancient days could comfort Solomon in all his wisdom and glory when he was sick of love, and for which he sighed, must indeed have been better eating than Ben Davis—our most abundant market variety.

Before taking up the matter of varieties, I must say a few words about the factors that influence the behavior of varieties as we see them growing in different places.

We often speak of a variety as if it were fixed and invariable, when in reality a variety is largely the product of the conditions under which it is grown—that is, its environment. And as environment is changed, so is the variety changed—sometimes beyond the point of recognition even by the best experts.

In order to give greater significance to what I may say about varieties, I want to mention somewhat briefly the more important factors that make up the environment under ordinary conditions of orchard culture. To say that a variety is good or otherwise in a particular place means but very little fundamentally, except as such statements are interpreted in terms of environment.

This is not the connection in which to discuss in detail even if I could do it, the conditions that prevail in the different sections of your State but reference to the factors of influence should assist in making the necessary applications in each individual case.

In rough analysis of environment, the factors of influence fall into two groups—climate and soil. Cultural conditions constitute a most important factor in the case but this is so primarily, because of their relation to and effect upon the soil factor of environment.

Though the climate may effect the roots of our trees, its greatest influence, generally speaking, is on the part above ground. The soil on the other hand is not without its influence on the top, but as generally considered it determines the environment of the roots.

Going still further in reference to the climate, we may say that the climate of any place consists of:

1. Atmospheric pressure.
2. Temperature.
3. Rainfall and snowfall.
4. Time and frequency of frosts.
5. Extremes of heat and cold.
6. Direction and velocity of the wind.
7. Amount of air that flows from the different points of the compass.
8. Amount and intensity of sunshine.
9. Humidity and transparency of the atmosphere.
10. Electrification of the atmosphere.

Without entering upon any discussion of these elements of climate in their relation to fruit growing, the enumeration of them serves to indicate that the climatic influences are exceedingly complex. I feel reasonably certain that a better understanding of them would explain many things that are now seemingly past our comprehension.

The soil factors are also complex in their relationship to fruit growing but, personally, I am much inclined to attach less importance than some do, to the extreme distinctions that are sometimes made regarding soil types and soil influences in relation to fruit growing. In fact, some of the factors that are commonly grouped with soil influences and which are exceedingly important, do not belong with the soil factors at all when rightly considered. For instance, we say a soil is too wet for a fruit soil. We commonly think of this as a soil characteristic and from one standpoint perhaps it is. It is true that soils which differ in their physical condition may and do also differ with regard to their moisture or water content. But generally speaking in the case of a soil that is too wet for fruit growing it is a matter of location or a matter of drainage—not matter of soil, per se, at all.

Again the amount of humus in a soil will greatly modify its physical condition and consequently its suitability for fruit growing. But the humus content of soils is very largely a matter of soil management and is not characteristic of one type of soil more than another, except perhaps as conditions of location and past history are such as to produce what is commonly called "muck" or some other type that is composed almost entirely of decaying vegetable matter rather than being made up largely of decomposed rock or other inorganic substances.

Do not misunderstand my position with regard to the importance of soil conditions. I would not minimize the importance of the soil factor in the least. But I would emphasize the relative importance of climatic and cultural conditions. As to the latter, you all know very well how strikingly good cultivation, pruning, fertilizing, spraying, etc., affect the behavior of varieties in contrast to conditions of neglect. But those operations are not factors of environments. Rather they modify or control environments. I need not spend any time on this point.

A word more, however, about the climate is in order. The elements of climate have already been enumerated. These elements as they prevail in any place are modified by several factors that we often overlook. Among them there are:

- (a) Topography, both local and continental.
- (b) Proximity to large bodies of water.
- (c) The latitude of the place.
- (d) Its elevation, both actual and relative.

We all know the desirability of a relatively high location for fruit growing. But perhaps it does not often occur to us that a high location is preferable because of the influence of elevation on local climatic conditions.

Just one more word about the soil in order to say that the soil features which I believe is inherently the most important, is one that is commonly very largely overlooked. I refer to the subsoil. In speaking of the condition of the soil, we ordinarily refer to the few inches that the plow turns over and do not go much deeper in our consideration of it. I believe that the condition of the soil or rather the subsoil, three feet or five feet and perhaps even at a greater depth is vastly more important in its relation to fruit growing than the usual surface conditions and the upper subsoil possibly that we are accustomed to talk about and to consider. I feel confident that many of the apparent mysteries that we very often find in fruit growing have their explanation buried in the soil much deeper than our considerations usually take us.

With these cursory remarks about some of the factors that affect the behavior of fruit varieties and determine their adaptability to particular conditions, I turn to the real subject of my paper. It should be remembered, however, that Pennsylvania is a large State and represents a wide range of all the conditions that influence the behavior of varieties. Very few varieties are equally valuable throughout the State. The northern part of the State is in what is sometimes called the Baldwin-Greening-King belt, while the southern part, especially the southeastern portion is in the Ben Davis-York Imperial-Winesap belt.

OLD VARIETIES THAT ARE GOOD.

Of course in this consideration, we must include the varieties just named, though by the exact terms of my subject, I have no real right to refer to Ben Davis. It is an *old* variety to be sure, but not a *good* one. I know there are many who say that it is their best moneymaker. But will you be offended at my frankness if I say that such a claim comes very near being a self-incrimination. Perhaps this variety *does withstand* the conditions of neglect that prevail in some orchards better than many varieties do. Is that why it is relatively the most profitable sort? Sometimes this is undoubtedly the case.

But the situation with regard to Ben Davis is simply this: A brand of any commodity in general use, it matters not what it is, that is of poor quality in comparison with other brands, and is put on the market in large quantity, is a detriment to the trade in that commodity and restricts its use. Ben Davis corresponds to a brand of goods of poor quality that is put on the market in large quantity.

I firmly believe it restricts the consumption of apples. The great trouble with whiskey is that it *creates a taste for more*. If it wasn't for this fact there would be no whisky and no temperance problem. Ben Davis apples *never in the world created a taste* for more apples. On the other hand, when a consumer to whom the name of a variety means nothing—and this is true of the mass of people who are supplied by the retail trade—gets a half-peck or peck of nice looking Ben Davis apples and attempts to eat them, he concludes forthwith that he doesn't care much for apples. And who can blame him? His appetite for apples is satisfied and it's a long time before he orders more. But when a supply of really choice apples is obtained the tendency is for it to be renewed as soon as it is exhausted. In other words, a *taste for more is created* and the consumption of apples is increased thereby. The demand for them is increased likewise. And you come right back to that old law of supply and demand as a price regulator.

In this line of argument I am sure my logic is sound and I do not believe my conclusion can be successfully contested. If this be true, then every barrel of Ben Davis apples that goes into the retail trade is a detriment to the trade because of its influence on the demand for increased supplies of fruit. I speak of Ben Davis as if this was the only offender. It is the chief one because of the relatively large quantities of it that go into the trade; but all varieties of poor quality are guilty of the same charge of which I accuse Ben Davis.

Some very discriminating varietal critics say that Baldwin barely escapes this charge and with all due respect to the prejudice which loyal Pennsylvania fruit growers may have in favor of York Imperial because of its place of origin, that variety isn't any too good in quality.

Having now cleared the varietal atmosphere in this way, I can proceed with my subject. Reference to other varieties is made about in the order in which they ripen.

Yellow Transparent.—For a very early sort this has few if any equals. It is grown throughout a remarkably wide range of country, and there are few sorts that are so well adapted to so many different conditions as this one. Its season in this State is probably from the first to the middle of July, depending upon the location. While the tree has some faults, they are not as a rule serious. It bears very young and is sometimes used as a filler. It was formerly considered too tender fleshed for a market variety but experience has demonstrated that when properly handled it is very valuable for commercial purposes.

Early Ripe.—This variety closely follows Yellow Transparent and in the early apple growing section of Delaware, it is considered one of the most valuable sorts.

Red Astrachan.—This is another variety that is very widely grown and generally with fair satisfaction. It has some faults and would probably be discarded if there was a good red variety of its season to substitute for it.

Williams, Williams Favorite, Williams Early Red.—This is a most excellent variety to follow Red Astrachan. In central Delaware its season begins from July 15th to 20th. It is of good size, beautiful in appearance and of fairly good quality. It does well



FIG. 3.—YELLOW TRANSPARENT.

One of the best of Early Summer Apples. Note the heavy load of fruit.

under a wide range of conditions and would probably be valuable for its season in many sections of this State both for market and home use. Some confusion exists in Delaware and New Jersey regarding this variety. Sops-of-Wine, a variety much inferior to it, has in some cases been planted for it under the synonym, *Williams Early Red*.

Early Cooper.—This is another early variety of much value in some regions. It is frequently found in the orchards of Oklahoma and Kansas as well as in other states. Its importance in some sections of the Middle West together with its good quality, suggests its possible value in some parts of this State.

Maiden Blush.—This is a standard for its season which follows Williams in good sequence. In most parts of this State it probably ripens during August. It is widely and extensively grown in many parts of the country.

Gravenstein.—This is a good running mate for Maiden Blush. Possibly it is more influenced by its environment than that variety is but where it does well, it is of better dessert quality, and an excellent variety for culinary purposes.

Wealthy.—This is a variety of growing importance. It is of good quality and fine appearance; not over-sensitive to the influence of conditions, it can be made to fill place in season and otherwise that is not filled by many other sorts.

There are many other early varieties of much merit which would doubtless prove valuable in some parts of this State, both for home use and for market but time permits reference to them only by name. Some that I would especially mention are: Benoni, Jeffries, Early Joe, Oldenburg, Chenango, Fanny, Red June, Primate and Starr, the latter an early apple of growing importance in New Jersey and elsewhere. Other varieties might be named which would perhaps be equally valuable as the above but the list cannot be extended indefinitely.

Passing to the mid-season or fall varieties, there are fewer candidates for favor.

Bonum.—I do not know what this variety would do as far north as this State. In the Piedmont region of Virginia it is a most excellent variety. Highly colored, medium size and of excellent dessert quality. It is a very satisfactory variety in that region for a September trade. For a personal market, a hotel or some other special trade it could not fail to be a "reputation maker." Perhaps it would not be as valuable as far north as Pennsylvania as it is in Virginia.

Mother.—This is an apple of exquisite dessert quality and ought to be planted for home use much more commonly than it is. The tree is rather small but of moderate growth. Probably it is improved by top working on a stronger growing tree such as Northern Spy. I am told it is doing well in Harford County, Maryland. Its high dessert quality commends it for very thorough trial.

Celestia.—While this is an old variety, it is not much grown. Perhaps it is better known in Ohio and some other parts of the Middle West than elsewhere. Its color which is rather greenish and not altogether attractive is against it but its quality is such as to commend it very highly to many growers. For a fall variety, it is worthy of consideration in this State, at least for home orchards.

Smokehouse.—This old variety does credit to your State in which it originated. It is not being grown as extensively as its merits justify, though it is found in many sections from here south to Virginia and occasionally elsewhere. Possibly it does not come into bearing quite as early as some sorts but it is worth waiting for.

Grime's, Grimes Golden.—It is doubtful if this variety would be as valuable in the northern as in the southern part of the State, but in the latter portion it would probably do well. And as an apple of high dessert quality, it has few superiors. Some markets do not take a yellow apple as readily as a red one, so this is perhaps not as widely grown as it would otherwise be. When well-grown, it could hardly fail to prove satisfactory during the fall and early winter for a personal market where the grower comes in direct contact with the consumer. It is generally considered a short-lived tree. Probably the most satisfactory way to grow it is to top-work on some strong growing sort.

Jonathan.—This is a most excellent red "running mate" for Grimes and it is much grown in some of the regions where Grimes is extensively planted. It probably does not have as wide a range of adaptability as that variety has and might not be generally desirable in this State, yet is worthy of careful consideration. In quality it compares favorably with Grimes and is about the same in season. Its value as a storage apple is not generally recognized. At the Louisiana Purchase Exposition at St. Louis in 1904, cold storage specimens of this variety of the crop of 1903 were displayed in the Missouri exhibit in August of the Exposition year, which were apparently in as perfect condition and as good in quality and flavor as when they were stored.

Only a small number of the longer keeping varieties will be mentioned. I would call attention to the following:

White Pippin.—If this were a red apple it would doubtless be a leading candidate for popular favor. I have recently seen most excellent specimens of it from Maine, from New Jersey and from Missouri. It is apparently doing well in all these widely separated regions. It is better in quality than most of the more common commercial sorts. The tree is vigorous, fairly productive and by many it is considered a profitable sort. It is a fairly good keeper. Occasionally it is mistaken for Yellow Newtown.

Esopus, Esopus Spitzenburg.—This is one of the varieties that has helped to make Hood River famous. It is grown some in New York and several times I have seen very fine specimens of it from Virginia. While not considered a particularly heavy bearer and

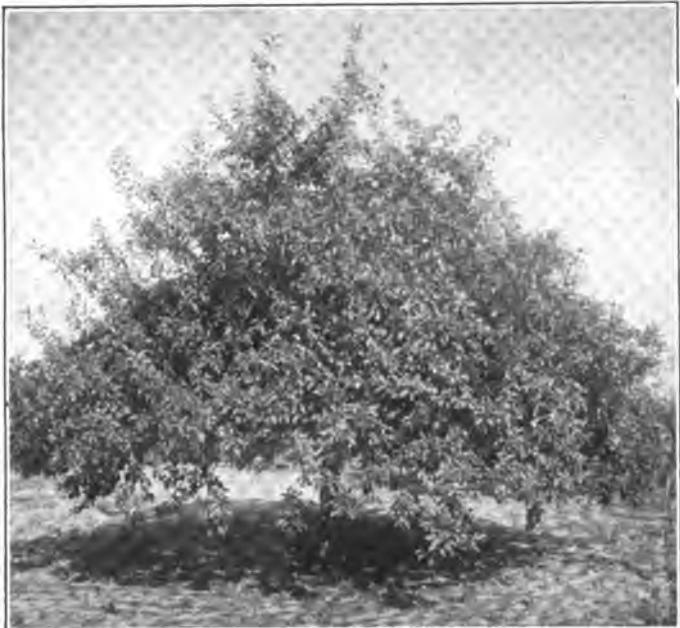


FIG. 4.—WILLIAMS' EARLY RED.
A very satisfactory Red Apple for early summer.

Dickey.—This is another old variety from Ohio that is but very little known. It is of medium size, fairly good color, a good keeper and in dessert quality it is considered by some to be entitled to a higher rating than almost anything in the apple line that ever existed. It originated in Ohio many years ago, but like so many other old varieties of merit, it has never had a sponsor who could talk about it enough to win public favor and general recognition for it.

To stop here with the winter sorts in which you are doubtless all more interested than you are in the earlier varieties, is not to do justice to the long keeping varieties, but time forbids further consideration of them. Besides it would weary you too much. I merely mention by name a few other sorts which because of their high quality or their merit in other particulars should be given consideration as of possible value to Pennsylvania fruit growers. A few such varieties are: Roxbury, Hubbardston, Tolman (Tolman Sweet) Swaar, Westfield, Evening Party, perhaps Winsap in some localities and I would add Arkansas if it was not generally such a shy bearer, and so on—almost ad infinitum. Not all of these would be desirable commercially, but I consider them all varieties of merit for one purpose or another, and worthy of consideration by fruit growers in this State.

NEW SORTS THAT SEEM PROMISING.

Turning now to some of the newer varieties, I must mention them with only a few comments. In passing I might say that it is difficult in this connection to make any very informal distinction between a variety of merit that has been recently introduced and an old sort of apparent value that has remained in obscurity all its days.

Wilson June.—This variety, though originating in northwest Arkansas 40 or 50 years ago, remained unknown outside of that section until a few years ago when it was propagated by one of the well-known nursery firms of the Middle West and by them extensively advertised. The statement in the catalogue of this nursery company, however, that it is identical with San Jacinto and Mrs. Bryan is surely erroneous. It is rather rich, sweet or nearly sweet apple of the Red June type in external characteristics, considerably larger, perhaps not quite as early, but of good quality and very attractive in appearance. Worthy of testing generally as an early sweet sort.

Summer Champion.—This is another early sort from northwest Arkansas that early apple growers should keep in mind for trial as it appears to be promising, though but little known.

Florence.—This is likewise a northwest Arkansas variety. I know of but one commercial orchard of it. It is about the same in season as Jonathan. It is a beautiful red apple of fairly good quality but not as choice as Jonathan. The tree, however, is a strong, vigorous grower and does not possess the weakness that Jonathan often shows. So far as I know it is not in cultivation outside the region of its origin. Worthy of being thoroughly tested.

Magnate.—This is a seedling that was grown by the late Dr. Stayman of Leavenworth, Kansas, who also produced Stayman Winesap. It is attracting some attention. It is beautifully colored

apple, medium to large in size, about 10 days earlier in season than the Jonathan, though it is said to keep till December. In dessert quality it is rated as very good. It is supposed to be a Winesap seedling and is considered promising in Winesap-growing territory.

Rabun.—This is a chance seedling that was found in northern Georgia about 1890. The fruit is large, beautifully colored, washed with mixed red, splashed and striped with bright crimson. Sub-acid, good to very good in quality. In northern Georgia, season is November to March. How this variety would behave in Pennsylvania is a question, but worth finding out.

Stayman Winesap.—Perhaps this variety has now been known to fruit growers too long to group it with new varieties, still I do not believe it is as generally known to fruit growers in middle latitudes as it should be. The tree is a fine grower, and a good bearer and the fruit possesses every quality to make it valuable both for market and home use. While the fruit often lacks color on young trees, this difficulty disappears as a rule as the trees attain a little age. I consider it to be one of the most valuable varieties for middle latitudes of recent introduction and look upon it as one of the sorts most likely to put Ben Davis "on the run."

Delicious.—This variety has been too much advertised during the past few years to call for extended comment at this time. It is of too recent introduction, however, for much actual information to be available at the present time relative to its range of adaptability but so far, indications point to its being adapted over a wide range of territory. It is of sufficient promise to warrant a thorough test of it throughout middle latitudes and well into the north. It may join honors with Stayman Winesap in routing Ben Davis and its allies.

King David.—In general the comments about Delicious apply to this variety. In season it is about the same as Jonathan and it admits of comparison with that sort perhaps better than with any other one.

Ensee.—This is a chance seedling which originated in southern Ohio about 1880, but it is only slightly known outside the region of its origin. It is a productive, regular bearer. Fruit of large size, surface washed with mixed red, splashed and brokenly striped with bright crimson. It is an apple of fine appearance, rich, sub-acid flavor, and very good in quality. In southern Ohio its season is late fall and early winter, keeping well in storage.

Carsen.—While this is really an old variety, it remains practically unknown to most fruit growers. It is another Ohio variety originating in the northern part of that State. It appears to have a rather unusual record for productiveness and regularity of bearing. It is a beautiful apple of good size and rated "very good" in quality. It keeps until March in northern Ohio. It would appear to be a promising variety for testing especially in the northern part of this State.

Bloomfield.—This variety first came to notice as a chance seedling in Montgomery county, Maryland. It has been slightly disseminated in Maryland and Virginia but is generally unknown. It is a large smooth apple, yellowish, washed with crimson and striped with darker red. The flesh is tender and juicy, rich sub-acid, good to very good in quality. Its season in the region of its origin

September to November. Its good appearance and high quality together with its other desirable characteristics recommended it for trial in this State.

Some other varieties that are either new or but slightly known and which might be of value to the apple industry of Pennsylvania are Coffman, Ingram (a), Doctor (b), Virginia Beauty (c), and Bennett (d). Many others might be mentioned but these are the "cream of the lot" that have come to my attention. There are also many unnamed seedlings of excellent quality that have received more or less notice and which appear to possess a good deal of merit.

Now I have mentioned just a few of the many old varieties that are good and a number of new ones that are promising. Perhaps many of you have in your minds the names of varieties of great value and have been wondering if they would be mentioned in the present connection. Perhaps some of you are saying to yourselves: "How could anybody fail to name this variety or that one?"—some sort which you know possesses particular merit. And you possibly are a bit disappointed because of the omission. I have only to say that this is by no means intended as a complete list of good or promising varieties for your State. I have merely attempted to call to your attention a few varieties which I believe to be of better quality than the bulk of the apples that are marketed and which are valuable in other respects for commercial purposes or home use, and if as a result of this discussion of varieties, there is developed a desire even on the part of a single individual to test some of these little known sorts of high quality, and that desire is not satisfied until the testing is undertaken, I shall feel as if I had sown a grain of mustard seed which may sometime grow into a good sized tree. I wish every State Horticultural Society in the country could maintain trial orchards in representative sections of the several states for the purpose of testing a large number of varieties of different fruits which are likely to prove valuable in those sections. Within the lifetime of a generation the variety lists would be very greatly changed and improved by such a course.

SOME NEW SPRAYING MIXTURES AND THEIR VALUE AS FUNGICIDES.

By M. B. WAITE, *Pathologist in Charge Fruit Disease Investigations, U. S. Department of Agriculture.*

For over twenty years Bordeaux mixture has been the leading fungicide. Its early successes in the treatment of grape diseases were followed by similar triumphs in the control of apple scab, apple leaf-spot, pear scab and leaf-blight, and finally the dreaded bitter rot. The apple blotch of the Southwest, curl leaf of the peach and the gumming fungus of this fruit on the Pacific Coast gave way before this remarkable fungicide. Following its discovery in 1883

or '85 for a period of about ten years,—that is from 1885 to '95, many efforts were made and much experimenting was done in the hopes of finding a better copper compound. It was hardly thought possible that the best copper spray had been hit upon at first. These efforts to find a better copper compound did not succeed. On the other hand, they placed this mixture at the head of the list of fungicides. Practical use by orchardists in the protection of their fruits by spraying still further strengthened the status of this fungicide until it had come to be regarded as the only great fungicide for general use in the orchard in the summer time.

General use of this mixture, however, both by experimenters and orchardists, began to develop certain weaknesses. It was soon found to be a complete failure on the peach and the Japanese plum, injuring the foliage so badly as to be ruinous. It also injures the foliage of a number of other plants. In recent years it has been found to cause serious russetting of the fruit of the apple and sometimes a similar russetting and deforming of pears. This russet damage apparently has been increasing, for reasons entirely unknown to the writer. For instance, in 1899, I carried on experimental sprayings on the Newtown in Virginia, with no noticeable injury to the fruit. Furthermore, the foliage of the sprayed trees remained sound and bright instead of being seriously injured as has been the case in the last few years.

Various recommendations were made last season to avoid this fruit russetting and foliage injury. One was to dilute the copper to 2 lbs. and add an excess of lime, using such a formula as 2 lbs. of blue stone, 3 lbs. of lime to 50 gals. of water. Another was to use the self-boiled lime-sulphur, then coming rapidly into prominence through the experiments of Mr. W. W. Scott, of the Bureau of Plant Industry. Mr. Scott developed this self-boiled lime-sulphur as a summer spray for the peach, the most susceptible to copper poisoning or spray injury of any fruit. He also found it harmless on the apple.

It was a question, and still is for that matter, whether the self-boiled lime-sulphur will serve all the purposes as a fungicide, of Bordeaux mixture. Notwithstanding, therefore, the possible ways out of the difficulty it was felt, at the beginning of last season, that the whole system of apple spraying by the old method with Bordeaux mixture was open to serious question. On the other hand fungous diseases appear to be rather on the increase, especially the apple leaf-spot or leaf-blight, cedar rust, and the danger of bitter rot and apple scab is always so great, not to speak of the insect troubles, as to compel thorough spraying of the orchards. All will admit that spray we must to get high percentages of sound, marketable fruit. What to spray with, therefore, and not introduce a new distributing injury, was the question. Something had to be done to get further light on this problem. What the orchardist needs is a fungicide which can be combined with a good insecticide, like arsenate of lead or possibly Paris green, or some other arsenate, that will do thorough work in the prevention of the diseases and at the same time be absolutely non-injurious to both fruit and foliage.

The ideal fungicide not only protects the fruit through various stages from the attack of fungi, but combines readily with an arsenical and leaves the skin bright and smooth with all the style and

finish that it is possible for the given variety of apple to develop. With the leaves, it should not only protect them completely from all attacks of fungi, but should permit or even stimulate full development of the foliage so that every leaf, or at least a very high percentage (90 per cent. or more) should be on the trees at the time the fruit is picked. They should even persist for a considerable period thereafter. You all know how far short of this condition has obtained in the use of Bordeaux mixture during the last few years.

In order to study this matter thoroughly a rather elaborate series of experiments was carried out at Winchester, Virginia, during the past season (1909). Nine different fungicides, that is counting arsenate of lead used alone as one, were included in the test, which, together with a control plot at the beginning and end, made eleven plots. The object of this test was to bring into careful comparison standard Bordeaux mixture, with various modifications of the same, and with self-boiled lime-sulphur and other sulphur compounds. These were the most promising fungicides known to the writer. Among the number, two new fungicides were invented and subjected to test, namely, a new copper sulphide mixture and a new iron sulphide mixture. Rather to our surprise these two mixtures have proved to be remarkably good and interesting. One of them, the new type of iron sulphide, may have a promising future.

The plan of the principal experiment carried out in Mr. S. L. Lupton's home orchard was as follows:

Purpose.—To find a spray mixture which will satisfactorily control fungous diseases but which will not injure the leaves and fruit of the most susceptible varieties of apple.

Carrying out of the Experiments.—In carrying out this plan two main series of experiments were tried:

Series I.—On the S. L. Lupton Home Farm. This block contained the whole eleven plots of the experiment. Each plot consisted of 4 Ben Davis, 4 Newtown and 2 York Imperial trees, except where they were missing in the orchard, all of which were fourteen years of age. In other words, the orchard was planted in strips of 4 rows each of Den Davis, Newtowns and York Imperials. The fungicide tests were run across the strips including all three varieties.

Application of the sprays was at the rate of 45 to 50 gals, to each plot of 10 trees, applied through ordinary fine nozzles by means of a hand barrel pump. The dates of application were the three ordinary applications for the apple required for codling moth and other insects, combined with the treatment of apple leaf spot, cedar rust, and ordinary fruit spots. This did not fully cover the early treatment for apple scab, which was not expected and did not occur in the orchard, nor one late treatment for bitter rot.

better. It is intended to catch the codling moth at the time of hatching and feeding, and as the trees are just in full leaf, is the best time to spray for apple leaf spot, and perhaps also cedar rust. It is doubtless the most important single treatment. The third application, on July 19, also possibly a week later, is an excellent date for last summer treatment for fruit spots and leaf diseases and is timely for second brood codling moth and lesser apple worm. These dates were arranged in conference with Prof. A. L. Quaintance of the Bureau of Entomology, who is responsible for the insect information in this paper.

Series II.—S. L. Lupton orchard (Barker Farm.) As the trees in Series I carried but a light crop of fruit, a supplemental experiment, or a duplicate, was carried on in Mr. Lupton's "Baker" farm, selecting the more important or more promising of the fungicides. Unfortunately we left out the iron sulphide as we did not consider it, at that time, especially promising. This series was located in a block of Ben Davis trees, 14 years old, larger and better cared for than the home farm and carrying a fine crop of fruit. Each plot consisted of 4 Ben Davis trees. The spray dates, May 12, June 14 and July 17, were within a day or two of the other series.

Series III.—A supplemental series was also carried out in the orchard of Mr. Stuart Bell, using about the same dates of treatment, but selecting only the self-boiled lime-sulphur and the copper sulphide mixture for comparison.

Series IV.—P. H. Gold farm, Winchester, Va. Another supplemental test on York, and Ben Davis trees, using also about the same dates of treatment, was carried on on Mr. Gold's place, comparing the self-boiled lime-sulphur with standard Bordeaux mixture.

To all these gentlemen our thanks are due for offering their orchards for experimental purposes. We feel that special thanks are due Mr. S. L. Lupton, because, on account of having the right varieties, suitable location, age of trees, etc., his orchards were made to carry the brunt of the experiments. We are indebted to Mr. Lupton for many courtesies, not only in facilitating the spraying work, sacrificing his fruit to these tests, but in helping in taking down the results and in storing the fruit and exhibiting it for our study.

I am also indebted to my assistant, Mr. F. V. Rand, for much painstaking help in carrying out the spraying work and in attending to the details of result taking.

RESULTS.

We began note taking on the results at the time of the second treatment on June 12. Interesting things began to happen at that date. All the copper sprays began to show more or less serious injury to both fruit and foliage. Notes were taken separately on the leaves

All the fungicides protected the trees very nearly completely from fungous diseases. In the note taking, therefore, except on the unsprayed plats, it became almost wholly a question of per cent. of injury to foliage by the spray itself, and in the same way on the fruit it was a question of per cent. of russetting or spray injury. I have all the data in my hand of these different percentages, including final notes, and per cents. of first and second-class fruit, drops and culs, at the picking time, but of course you do not wish this mass of detail.

Let us pick out from the whole the most interesting and instructive portions. The final notes of the condition of leaves and fruit on each of the plats, taken September 21, a few days before picking, may be of interest.

Series I.—S. L. Lupton's home farm. Percentages indicate amount of damage estimated.

Plot I.—Control, unsprayed. Ben Davis, 4 trees:

Leaves—

Fungus,	.....	60 per cent.
Spray injury,	.....	None.

Fruit—

Insect and fungus,	.....	90 per cent.
Spray injury,	.....	None.

On the Newtown and the York Imperial there was a slightly less serious injury.

Plot II.—Bordeaux mixture 3-3-50. Ben Davis, 4 trees:

Leaves—

Fungus,	.....	1 per cent.
Spray injury	.....	30 per cent.

Fruit—

Fungus and insect,	.....	2 per cent.
Spray injury,	.....	60 per cent.

Newtown, 4 trees:

Leaves—

Fungus,	.....	3 per cent.
Spray injury,	.....	80 per cent.

Fruit—

Fungus and Codling moth,	.....	2 per cent.
Spray injury	.....	30 per cent.

York Imperial, 2 trees:

Leaves—

Fungus,	.....	2 per cent.
Spray injury,	.....	25 per cent.

Fruit—

Fungus and insect,	.....	2 per cent.
Spray injury,	.....	3 per cent.

It will be observed that standard Bordeaux mixture injured the fruit by russetting from 60 per cent. on the Ben Davis to 30 per cent. on the Newtows to 3 per cent. on the York Imperials. The foliage, on the other hand, was most injured—up to 80 per cent. on the Newtows. All the other copper compounds injured the fruit of the Ben Davis with the exception of neutral Bordeaux, however, all of the modifications of Bordeaux, by adding other materials, reduced the injury.

As the whole group of copper compounds except copper sulphide injured the fruit so much as to be undesirable, I will only take one single element of the notes on most of this group, namely the russet injury on the Ben Davis fruit, assuming that the other injuries were somewhat in proportion.

Plat 3, the iron Bordeaux injured the fruit 40 per cent. It was decidedly less injurious to fruit and foliage on the Newtown and York Imperial.

Plat 4, Bordeaux and Gypsum. Fruit russeted on Ben Davis 30 per cent. It gave about a corresponding reduction of injury on Newtown and York Imperial. The reduction of injury by gypsum and iron Bordeaux would be of interest if it were not for the more successful fungicides in the test.

Plat 5, Neutral Bordeaux. Fruit of Ben Davis russeted 60 per cent. The interesting thing happened in this mixture, namely, that while it injured the Ben Davis no more, or possibly slightly less during part of the season, than standard Bordeaux, it injured York Imperials much more seriously. It therefore had no special advantage—if anything, a disadvantage, over standard Bordeaux mixture. This emphasized the fact, which had heretofore been found in spraying the peach, that a slight excess of lime was helpful. This is also further backed up by the comparatively better results obtained by Mr. Lupton in his orchard spraying with the lime 2-3-50 Bordeaux.

Turning now to plat 7, the copper sulphide, we have a change in the figures. The Ben Davis fruit was injured only 10 per cent., the foliage was injured only 1 per cent. Further than this, all the other marks on both the Newtown and the York were practically perfect. Here again we can say that were it not for the superior results with self-boiled lime-sulphur and iron sulphide we should certainly consider that in this new fungicide we have a splendid find. We certainly can say this, that if sulphur mixtures do not hold out, we have in the copper sulphide, made with self-boiled lime-sulphur as a basis, the least injurious form of copper. On the Newtown, and on the York Imperial, and possibly this may be true of other varieties, it is almost, if not quite, absolutely harmless. The 10 per cent. of russetting on the Ben Davis might be reduced by cutting down the amount of copper.

Turning now to plat 8, this is also a copper sulphide, but made with the commercial lime-sulphur solution instead of the self-boiled lime-sulphur. It was distinctly inferior to the other type of copper sulphide. The russetting of the Ben Davis was only slightly more serious, being 15 per cent., but the foliage injury throughout was quite pronounced, being 10 per cent. on the Ben Davis, 40 per cent. on the Newtown and 15 per cent. on the York Imperial.

Turning now to the really good things in the test we are able to abandon this record of troubles almost completely. Plot 6, the self-boiled lime-sulphur, gave almost perfect results throughout. There are absolutely no spray injury to both fruit and foliage on the three varieties tested. There was a half per cent. of russetting marked on the Ben Davis but this is wholly around the stem and was undoubtedly due to the arsenic or to water alone. The percentage of fungus injury to leaves was slightly greater with this fungicide as might be expected, namely, 2 per cent. on the Ben Davis, 3 per cent. on the Newtown and 4 per cent. on the York Imperial. This was mostly cedar rust and apple leaf spot and was

entirely insignificant in quantity. They are just enough perhaps to call attention to the slight doubt as to fungicidal strength which hangs over this mixture. Undoubtedly the self-boiled lime-sulphur mixture is the most harmless fungicide known. The only question being, can it be depended upon to do the work. Under the conditions obtaining at Winchester last season it stood up very well. It failed, however, on pecan scab in the South, due, probably, to very heavy rains, and as Mr. Scott has pointed out in his apple scab work, it has not quite equal to Bordeaux mixture. It also was inferior to Bordeaux mixture in my own orchard with apple leaf spot, and the fruit spot of the apple, though on the whole the results were better than with Bordeaux mixture.

Turning now to the last fungicide, namely, the iron sulphide, we have apparently the most successful mixture in the series. The fruit russet on Ben Davis was zero and so was also the leaf injury. A perfect mark was secured as to leaves and fruit of all varieties. The fungus injury on leaves of all three varieties was marked at one-half per cent. This was less than with any other fungicide on the test, including the Bordeaux mixture, although with the Bordeaux mixture there is a possibility that some of the spots marked "fungus spots" may have been copper poison spots. In this mixture (iron sulphide) we have the advantage both of high fungicidal value and an entire absence of injury effects,—apparently the best combination of quality.

It should be noted that the fruit of the Ben Davis particularly was slightly a darker green and apparently later in ripening than on most of the other plats, notably, than on the self-boiled lime-sulphur. In one case of the Pippin this made a greener appearing type of fruit. On the Ben Davis it perhaps might be regarded as slightly objectionable though probably not on the Pippin and York Imperial. The foliage also looked darker green and heavier and it was a noticeable fact that the twig growth looked more stocky and especially the fruit buds looked plumper, than with any of the other fungicides.

One point should not be overlooked, namely, that the arsenate of lead gave remarkably good results and entire freedom from russet injury. Some of the Winchester orchardists, namely Messrs. Bell, Gold and Richardson, called my attention to the apparent success of this insecticide in controlling fungi which they had observed in the season of 1908. At the time I doubted it but the results of the arsenate plat certainly looked promising. The two pounds of arsenate of lead under the extremely favorable conditions in the Winchester district seemed not only to protect from insects but to control apple leaf spot, cedar rust, and the fruit spots.

Since this mixture was also in the self-boiled lime-sulphur and in the iron sulphide solution the question may be raised, was it not practically responsible for the beneficial effects. Self-boiled lime-sulphur, however, has a series of victories in Mr. Scott's experiments that do not rest on this single test.

Iron sulphide, made with a sulphur solution, in the experiments of Mr. Volck, at Watsonville, Calif., on apple mildew and by Mr. W. S. Ballard, my assistant in that district, have shown it to be superior to Bordeaux mixture, for that disease. Why may not this superiority extend to certain other fungi?

CONCLUSIONS.

Self-boiled lime-sulphur gave practically perfect results under the conditions obtaining at Winchester. As a spray for Ben Davis and perhaps also for Newtown and York Imperial it was a practical success. Since it has been experimented upon widely by Mr. Scott for three years, it may be regarded as a perfectly safe fungicide to use for commercial purposes as far as injury is concerned.

It is evident also from the tests that the iron sulphide, made in the new form here described, is a promising fungicide which needs testing on a commercial scale. If it maintains its apparent superiority it may have practically all the advantages of the self-boiled lime-sulphur in overcoming injurious qualities and of Bordeaux mixture as an effective fungicide. In that case it promises to be a great commercial spray. Copper sulphide is the least injurious form of copper spray and solves the russet problem as far as the Newtown and York Imperial are concerned, and gave only one-sixth of the injury on the Ben Davis produced by 3-3-50 Bordeaux. We have in these experiments the solution of the russet problem in several different ways. Further experiments on a large scale are necessary to test fully the merits of the different non-russetting sprays. The results argue strongly the necessity of abandoning Bordeaux mixture on the apple and the substitution of some form of lime-sulphur, iron sulphide or possibly, if we must use copper, the copper sulphide.

PREPARATIONS OF THE NEW SPRAYS.

At the conclusion of the paper, a sample jar each of the new mixtures was made up and also for comparison the standard Bordeaux mixture, self-boiled lime-sulphur, with and without the arsenate of lead. The materials being of very bright colors, varying from light blue to bright lemon yellow and from reddish brown to jet black, made a very interesting color contrast. Bordeaux mixture, made up in the ordinary way, showed the characteristic sky blue color.

A batch of self-boiled lime-sulphur was made up suitable for spraying peaches. It was diluted promptly after the lime finished slackening and was therefore of a bright lemon yellow or sulphur yellow color. Another sample was allowed to stand twenty minutes while hot to complete the boiling, and while it was rather bright yellow in color, it showed a slight brownish tint and an inch or so of clear liquid at the top of the jar was distinctly brownish. A similar sample of self-boiled lime-sulphur was treated by adding the equivalent of 2 lbs. per barrel of arsenate of lead. There was a distinct though not very pronounced dull grayish-brown color produced a few moments after the addition of the lead arsenate. To another jar of the self-boiled lime-sulphur mixture a solution of blue stone or copper sulphate was added. On shaking up this developed the distinct reddish brown color of copper sulphide more or less obscured and modified by the excess of yellow lime-sulphur mixture. To still another jar of the self-boiled lime-sulphur mixture a solution of iron sulphate or ordinary copperas was added. This at once turned the mass to an inky black color. To complete

these last two mixtures lead arsenate was added to each of them but any further color change was obscured by the reddish-brown color of the copper sulphide or the black of the iron sulphide.

Formulae for the new sprays.—To prepare a barrel of either the new iron sulphide or the new copper sulphide, make first the self-boiled lime-sulphur as a basis. In experimenting we used the 10-10-50 formulae but for commercial work the 8-8-50 should be used.

To make the self-boiled mixture first place 8 lbs. of good stone lime in the bottom of a barrel; pour on enough cold water (hot water if the lime is distinctly inferior) to nearly cover the lime. When the lime begins to slack vigorously add 8 lbs. of sulphur flour. This should be run through a sieve and preferably mixed with a little water in the form of a slush. Stir the sulphur into the slackening lime occasionally. Keep the barrel covered with gunny sacking, old carpets, or some suitable cover to retain the heat. Water is added occasionally to keep the mass in a slushy or creamy cultivation. For these mixtures on the apple cease stirring as the slackening diminishes in violence and before it has finished, and replace the cover allowing it to remain twenty minutes. At the end of this period the mass will have turned slightly brownish. Dilute, first by adding a little water, and stirring, to 50 gallons.

For making iron sulphide dilute to about 40 gallons instead of 50, then add 3 lbs. of iron sulphate (ordinary copperas) dissolved in 6 or 8 gallons of water and stir. This makes the black iron sulphide. Then add 2 lbs. of arsenate of lead stirred up as a milk into two or three gallons of water, thus completing the barrel to 50 gallons. The formulae for this mixture then is:

Self-boiled lime-sulphur, 10-10-50 (or 8-8-50).

Iron sulphate, 3 lbs.

Arsenate of lead, 2 lbs.

To make the copper sulphide, proceed in the same way. After diluting the barrel of self-boiled lime-sulphur to about 40 gallons, add 2 lbs. of blue stone or copper sulphate dissolved in 6 or 8 gallons of water and stir. The mass will then turn to the bright reddish-brown color of copper sulphide. The 2 lbs. of arsenate of lead is then added, as above, to complete the mixture.

ASPARAGUS CULTURE.

By R. L. WATTS, *Professor of Horticulture at Penna. State College.*

Asparagus is generally regarded as one of the most profitable garden crops that can be grown in this State. Soil and climatic conditions in Pennsylvania are favorable and it is not a difficult crop to grow.

The most experienced growers claim that deep, rich, sandy loams are best adapted to this crop. Sandy loams are especially desirable if the purpose is to produce white grass rather than green, because sandy soil offers no obstruction to the shoots and they are always

straight and can be cut without difficulty. The tendency, on the other hand, of white shoots in clay soils is to become more crooked and the crop is harvested with greater difficulty.

There is an increasing demand for green grass, although the majority of growers claim that white grass is the more profitable. There are two main reasons for this claim. First, it is held that the injury from beetles is less on the white grass because a smaller per cent. of the shoot is exposed to the attack of the beetle. Second, that the diameter of the white grass is greater than the green and that fewer stalks are required to fill the bunches. When green grass is grown the rows may be closer together, because riding is not required. It is also true that the price for green grass is usually higher and this probably makes up for the loss in size of shoots. Nearly all Americans prefer green asparagus and its production should increase consumption.

Although the sandy types of soils are preferred, good crops may be grown upon any kind of soil which is properly handled. Heavier manuring is required on the sandy soils and these soils of course are less retentive of fertility. For growing either green or white grass, the most important factors are the supplying of water and plant food. These two factors are of vastly greater importance than the question of soil type.

Conover Colossal is one of the oldest and best known varieties in the United States. It is early and vigorous. Barr's Mammoth is also well-known. It is said to be one of the earliest and is a large producer of good sized shoots. Argenteuil is a French variety which has attracted much attention in recent years. It was thought by many a few years ago that this variety would take the place of many of the older varieties, but I believe it is losing rather than gaining at the present time. There is some evidence that the variety does not thrive on clay soils. A variety which is attracting more notice at this time than any other, and which is planted more largely than any other is Palmetto. The shoots of this variety are large and there is a small percentage of culs. It is generally regarded as the most profitable variety in cultivation. It is conceded that the variety is less subject to rust than any other, and some claim that it is comparatively secure from attack of insects. There seems to be no good reason for planting any other variety.

Many of the most successful growers of asparagus in different parts of the country prefer growing their own plants. They prefer this because it enables them to grow plants from selected seed and then to select roots from a large number of plants, from which the best results may be expected. To start with, seed should be secured from a reputable grower whose plantation is free from rust. An excellent plan is to visit these fields in the fall of the second year when seed should be selected from plants of a few large stalks rather than many small ones. The seeds are ripe when the berries are well colored. After picking, the berries should be placed in any convenient tub, barrel or crock and allowed to soak until the pulp separates readily from the seed. This separation may be secured by washing with the hands. The seeds should be washed several times and then cured and stored.

It is considered rather unsafe to use seed more than one year old. It may be planted in the fall, although spring is preferred. The drills should be fifteen to eighteen inches apart, and covered with

about one inch of soil. Some growers drill an early maturing variety of radish over the asparagus to mark the rows. The asparagus seed requires four to six weeks to germinate, so that the radishes do not interfere in the least with the asparagus plants. The asparagus nursery should be given clean tillage during the entire summer. Some growers prefer lifting the plants in the fall, choosing only the strongest for planting in the permanent plantation. If the ground is prepared early in the spring, the plants need not be lifted until planting begins, but the safer course is to take the plants up in the fall and store them in a cool, moist cellar or pit. Experiments at the Pennsylvania State College indicate that too much care cannot be exercised in the selection and planting of asparagus roots. This is one of the main arguments for growing your own plants. If the plants are purchased at about four dollars per thousand, it is not likely that many will be discarded, while if grown at home and there is a surplus of several thousand, the grower does not hesitate to select the strongest. It is important that thinning be practiced in the nursery with a view to growing the best plants. This should be done when the plants are about two inches high and they should be thinned to an inch or two inches apart.

In speaking of seed selection it is just as important to have plants with a few eyes selected for setting in the permanent plantation. The market demands large shoots and the tendency of the plants of few eyes is to continue to produce large shoots during the life of the plantation. The importance of seed selection and plant selection cannot be overestimated.

Preparation for field planting should begin in the fall. Asparagus makes the best growth in soils abounding in vegetable matter. This means that manure should be used with the greatest freedom and if clover sods are available, they should help materially in the starting of the plantation. Land of any kind which is to be planted with this crop should be heavily manured and plowed in the fall, repeating the operation and adding more manure the following spring. The plowing should be as deep as possible, although care should be exercised to avoid turning up too much of the subsoil if of a clay composition. Disk and cutaway harrows may be used to good advantage in the preparation of the soil. Effort should be made to secure a fine bed to the full depth of the plow furrow with all vegetable matter thoroughly incorporated with the soil.

Practice varies widely with regard to planting distances. A common plan in New Jersey and in other sections where white grass is grown is to set the crowns about two feet apart in rows from five to six feet apart. This provides ample soil for blanching. If green grass is desired, the rows may be very much closer. One of the most successful growers in the state, R. H. Garrahan, Kingston, Pa., plants two by four. Occasionally a grower is found who prefers the check system. For example, Hon. Thos. W. Barlow, of Philadelphia, Pa., who has twenty-five acres, plants four by four. He claims that by this system much hand labor is avoided and that the shoots are larger. The old method was to set the roots at a great depth, often twelve to fifteen inches. Deep planting is often practiced to some extent but many growers can see no advantage in planting at extreme depths. The depth should be determined by the character of the soil. If the purpose is to grow white grass

and the soil is a sandy character, then the crowns may be planted at a greater depth and ten to twelve inches under satisfactory conditions would not be too much. If on the other hand the soil is clayey, deep planting would be a disadvantage. It is probably never desirable to set the crown in the subsoil. This means that in most of our Pennsylvania soils the roots would seldom be more than seven or eight inches below the surface of the ground. Practically all of the soil in the furrows may be removed by means of a plow, so that little shoveling is required in preparation for planting. The roots should be kept moist and plump and not more than two inches of soil should be placed over the crown at the time of planting unless the soil is sandy or of an extremely porous character. Soil should be drawn up to the plants from time to time as the plants grow and if strong, vigorous roots are planted only a few weeks time will be required until the field is practically level. It is important to give the field clean tillage during the entire season. No weeds should be allowed to grow and soil moisture should be conserved by stirring the soil with tools which are best adapted to the prevailing soil conditions.

In beds which are more than two years old, tillage should begin just as soon as the ground is dry enough in the spring. Soil in young plantations may be plowed while in older beds a disk or spring tooth harrow can be used to advantage even if a few plants are displaced. The destruction of a few old crowns may often be an advantage. Before plowing or harrowing, stable manure should be applied and a good grade of commercial fertilizer should be added at the rate of not less than one ton per acre. Some very successful New Jersey growers apply annually two or more tons of fertilizer per acre and it is important that the fertilizer run high in nitrogen. A fertilizer analyzing four per cent. nitrogen, eight per cent. phosphoric acid and ten per cent. potash should give good results upon most soils.

There has been much discussion as to the proper time for the application of manures and fertilizer upon asparagus fields. The probabilities are that it pays to divide the applications using part in the spring before tillage begins and part in the summer immediately after cutting. If all the manure and half of the commercial fertilizer were applied in the spring and the other half of the fertilizer used at the close of the cutting season, ideal conditions should be furnished for the growth of the plantation. The disk or spading harrow can again be used to good advantage at the close of the cutting season. Various tools as riding cultivators, narrow spring-tooth cultivators, spike-tooth harrows and Planet Junior tools are used in cultivating this crop. Cutting should begin as soon as the shoots are large enough in the spring. The diameter and length of bunches varies with different markets and the grower should aim to

that the plants will not be weakened. Full cuttings may be made from the third year on, and it is important to remove everything of proper height at each cutting even if some shoots are too small to be sold. These unmarketable shoots may be left on the ground. It is seldom that asparagus is cut for market after the first of July.

The common asparagus beetle is about the only insect enemy that gives any trouble. It should be combated on young plants by arsenate of lead and on old plants after the close of the cutting season using the same poison. When this insect appears upon the young shoots in sufficient numbers to cause injury, air slaked lime can often be used to advantage. Rust is the only asparagus disease of any importance. Although various spraying materials have been tried, they do not seem to be effective in controlling rust. Precaution should be taken to avoid rust, by selecting seed of plants from plantations which are known to be free. The tops upon all plantations should be mown and burned in the fall of the year. This work should be attended to before the leaves are dry, so they will not shake from the plants and thus spread disease germs which would cause trouble next year.

MARKET GARDENING ON THE FARM OF THE LATE R. F. SCHWARZ, ANALOMINK, PA.

By L. W. ARNY, *Philadelphia, Pa.*

The farm and conditions found at Analomink, were by no means ideal, as that term is now used by the market gardener, but they were so clearly an example of what the possibilities are under extreme adverse circumstances, that we can learn many lessons from them.

Before taking up the actual farm practice, of Mr. Schwarz, it is well to look into the history of his farm to note how greatly he was handicapped from the beginning, and how he overcame the most of his difficulties and turned them into successes.

Mr. Schwarz was born in Berlin, Germany, and after graduating from a local school, entered the University of Heidelberg, where he completed his education. In his early manhood he moved his residence to America, in order to escape the laws of the German army. Having no business training, Mr. Schwarz engaged in the employ of a Chicago business house in the capacity of traveling salesman, in which business he was not only successful in his work, but made many friends throughout the country. After having traveled for some few years in this business, Mr. Schwarz found his health breaking, so that he was forced to resign from his position and consult a physician. Then he learned that he suffered from tuberculosis, and that specialists gave him but a few years to live. Having heard that the region around the Water Gap and Pocono Mountains in Monroe county was particularly favorable to lung

troubles, he decided to buy a home there, for reasons, as he expressed it, "To provide a home for his wife, and to find a good place to die in."

This home was the beginning of the recent "Schwarz Farm," and consisted of a small two-story house, with a small garden in the rear, probably being not over 100 feet by 50 feet. At the advice of his physicians, Mr. Schwarz spent most of his time out of doors—at first by simply taking long walks in the surrounding country, and then, later, by becoming interested in flowers, and planting and caring for these. He knew absolutely nothing of flowers, plants of any kind, or of the natural sciences governing their growth and care, but this deficiency was slowly made complete by a great amount of reading—the reading of reliable works relating to floriculture, horticulture, and all bulletins bearing on these subjects. This new work proved absorbing and so full of promise, that Mr. Schwarz decided to try it on his land, and if the bright prospects continued, to go into it commercially, and make it his life's work, or to make it fill the remaining part of his life, which he then supposed to be but a short while.

The house stood some 50 feet back from the Brodhead Creek, a small mountain stream winding through this part of the country, on almost level land with the main line of the D. L. & W. Railroad, running at the rear of his lot about 200 yards away. The soil, not only in the small garden, but on the surrounding land, was almost pure sand, with a great deal of loose stone, having been washed down from the mountain during the flood times of the stream.

Mr. Schwarz's first market garden efforts were with pole beans, but they did not thrive in the pure sand of his garden, and were the cause of some disappointment and discouragement. But by the time the failure came he had acquired enough agricultural knowledge to know that his land must be given body and more fertility before it could be made to give him success in market garden work. This was a phase of the work that had not occurred to him before, and the greatness of the task of building up any amount of that land, seemed such a barrier that future profits would be long coming if they came at all. But he was firmly convinced that market gardening could be made extremely lucrative if properly managed, and so set out to make his land fertile. This work was started by hauling away tons of muck from a swamp distant some two miles, and thoroughly incorporating this into the sand of the farm. This made a soil dark in color, friable, and with perfect drainage—an almost ideal soil for market garden work. An area of about seventeen acres was treated in this manner, giving a perfectly level area of excellent soil. Then crops thrived to perfection, the only limitations being Mr. Schwarz's knowledge to perfect a suitable rotation of crops and a rational system of fertility maintenance.

Having thus been discouraged with commission business, Mr. Schwarz decided to handle his produce directly to the large summer hotels of Stroudsburg and the Water Gap. This scheme not only promised greater financial returns, but also simplified the management of his place that that particular trade did not demand the exceedingly early produce that most markets want, and hence it reduced the amount of glass on the farm to almost a minimum. Two greenhouses were constructed, each 20 ft. by 60 ft., in which were started tomato and cabbage seedlings for the early crop, together with some few flowering plants, particularly pansies, which were used as a side line.

The question of maintenance of fertility was at first solved by using cover crops of crimson clover, and complete commercial fertilizers, but two serious objections were found to clover: first, it did not do well on the land; and second all crops were not off the land at the time it should be sowed. Here followed a period of experimentation with cover crops, particularly every available legume being tried, alone, and in combination with other grasses, the result being that a combination was effected which had more to do than any other one thing, with the success of the farm. This was the using of rye and vetch as a cover crop and nitrogen restorer. This combination was tried at first experimentally, until it proved its value, after which Mr. Schwarz became its champion—built his own farm up on it and preached it to his friends and neighbors. The success of this rye and vetch combination was due to several things: first, rye and vetch are plants that require no particular fertility of land upon which to grow; they will thrive where crimson clover will give but a poor stand, the vetch is a member of the legume family, and its properties of nitrogen gathering are as great as that of the clovers; and, lastly, both may be sown late in the season, at a time when crimson clover would be unable to get a start. The combination was found to be better than the vetch alone, since the rye acted as a nurse crop and assured the stand. After this cover crop had proven its value, the entire area of eighteen acres was sown to it in the fall, as late as September first to the fifteenth. The stand was luxuriant, protecting the land from any erosion during the winter, and providing a large amount of green manure to be plowed under in the spring.

From this period on, very little change was made in the management of the farm. The cover crops were sown late, and plowed under in the early spring, just as soon as it was safe to operate on the land. Every third year a solution of the soil was examined for acidity, and when enough acid was present, a medium application of lime was made over all but two or three acres. If the land was violently acid, this small area was planted in early potatoes. This system of having potatoes planted in slightly acid soil proved extremely satisfactory—giving yields of 250 to 275 bushels per acre, on the average.

Every spring the farm was given an application of commercial fertilizer, varying each time in its proportions, but always being low in nitrogen—sometimes 2-8-10, and averaging from 200 to 250, and often 300 pounds per acre. The reason for this small application of nitrogen, was the fact that there already was some in the

soil from the vetch, and the remainder was better applied immediately before planting in the form of NaNO₃, hence making the nitrogen at once available.

The cabbage, lettuce and tomato plants were started in the greenhouse in time to set out as soon as the ground was fit, when the other crops, potatoes, peas, beans, onions, carrots, beets, peppers, rutabagas, parsley, radishes, turnips, cucumbers and squash, were planted. Some varieties of these crops were unknown, but some of the most valued were: Radishes, French Breakfast and Crystal; Potatoes, Early Ohio and Carmen No. 3; Peas, Telephone; Beans, Bush-pole, Limas and Wax; Onions, White Globe and Egyptian; Carrots, Danvers; Beets, Eclipse and Egyptian; Cucumbers, White Spine; Tomatoes, an unknown variety—Earliana, Matchless, Globe; Cabbage, Danish Ball Head; Cauliflower, Snowball; Lettuce, Boston Market. These varieties made up the main crop, but in addition there were other varieties of different crops grown, which were unknown, and at the same time valuable. The seed for these was gotten from a friend in the New England States.

The original piece of land—that small plot forming the yard of his house, was used as a seed bed for lettuce and late celery. The celery mostly grown was White Plume and Giant Pascal. This plot proved very successful for his work, in that it had been longer worked than the rest of the land; had been intelligently worked, and was in a high state of fertility. Several small plots were devoted to radishes, and this being a short crop, soon released the land, after which it was planted to spinach, although some difficulty was experienced in getting a good, uniform stand at that time in the season. Peas were planted in rows three feet apart, and trained on brush stuck into the ground. When the harvesting of the peas was no longer profitable, the brush was pulled and piled in several heaps and burned, the ashes and pea vines being then plowed under. That plot was next given an application of NaNO₃, about 150 pounds per acre, and winter celery then set. Where early crops could be gotten out of the way, late cabbage was set, first being encouraged by a light application of nitrate of soda, and this, in turn, was harvested, and winter celery set out. In only one case was there any intercropping practiced, and that was in a small patch of sweet corn, in which squash was planted, the policy being to keep everything separate, to crowd to the limit, and force by abundance of plant food, especially nitrogen. A cultivator was always at work, each plot being cultivated at least once a week, up to the time when the crop was large enough to be injured by the passing of the horse and machine.

Water began to be a serious problem on the farm, for, while Broadhead Creek was convenient, and a powerful windmill had been erected to pump the water, there were certain seasons in the year when the supply was limited, and it was usually at seasons when the water was needed most. This difficulty was overcome by building a dam some two miles distant in the mountains, and piping from there. From this main pipe, laterals were run into the main fields, and in dry weather, the water was allowed to run slowly all night, making for itself rude irrigation ditches, and although this method of irrigation was rough and simple, results showed it sufficient to

meet the demands of the case. Never did a crop suffer from drought, for the water supply was always good, and placed so that it could be had where it was most needed.

Some trouble was experienced at first by the ravages of the asparagus beetle, but this enemy was later easily controlled by sprinkling powdered lime on the plants early in the morning, while the dew was still present. The potato beetle was controlled by applications of Paris green and lead arsenate, made whenever the insects became numerous, so that no serious loss was experienced from these pests.

After a few years of successful trade at the Water Gap and Stroudsburg, competition came in and limited the market to such an extent that a greater outlet for the produce had to be sought. This outlet was found, but it involved a tremendous amount of extra work and expense. This market was at the big _____ Pocono, and although they were larger, demanded first-class produce, and were fairly numerous, it was a long and hard trip to get to them, but as the scheme offered the only solution to the problem, three wagons and teams were gotten, and the product hauled eighteen and twenty miles over rough mountain roads. The system worked out for these wagons was this: each driver, knowing the demand for his particular trade, would put down on a provided slip, the load he would probably need for the next day. This was done after his turn in the afternoon; his wagon would then be loaded according to his slip as he had made it out, backed into a shed, and was ready for the following day's business. While this system of marketing, made possible the disposal of a large amount of produce, the expenses resulting from the wear and tear on the wagons and teams from such hard use, cut the profits down much below what they would ordinarily be. This was the greatest contention of the business, and one that could not be overcome, but merely reduced to a minimum.

A few years before the close of the farm's history, some twenty-seven acres of land on the opposite side of Brodhead Creek was offered for sale. This land Mr. Schwarz purchased, and although it was poor in quality, he decided to try fruit on it. The same factor of building the soil up presented itself, as was the case with the original land, but owing to its hilly character and the great expense of hauling in muck, it was simply given the treatment of rye and vetch, together with commercial fertilizers. This new land was divided into four fields, three of which were set in apples, but the choice of varieties made was unhappy, so that they never were a commercial success. They were all early summer apples, chiefly Sweet Bough and Yellow Transparent, for which there was such a limited demand that the possible prices would not pay for the proper treatment of the orchard; hence the result was that the land was given over to sweet corn and the apples ignored, except to pick the most perfect specimens and sell them to the best advantage. For the corn, the land was treated with rye and vetch, up to a point where it was in fairly good condition, and then crimson clover was used. This crop worked just as well since late sowing was not the important factor here that it was on the old land. The fourth field of the newer land was planted in cherries, pears and raspberries, both black cap and red varieties, but the original land claimed so much attention that all of these newer fields were more or less neglected, so that the maximum returns were not gotten. Although

this was probably bad management, it was due to the fact that the original land was the part of the farm that was making the money—that the new area was far inferior in fertility, that this section was nearer population, and being remote from the main part of the farm, much theft had to be contended with, and, lastly, that Mr. Schwarz felt that his remaining years were numbered, and the process of making his new land rich was too long a one for him to undertake.

There were many little points in the management of the place that were original, and, while being small in themselves, added greatly to the success of the farm. For instance, in the plowing under of crops, such as cover crops or pea vines, instead of simply running through with a plow, as is most often done, the disc harrow was first used. This broke up the material into finer parts, making further plowing easier, and insuring a quicker decomposition of the material. This harrowing was followed by a plow, when the operation was easy, quick and more efficient. The plow was followed by the disc, after which the fertilizer application was made. Then a smoothing harrow was used, followed by a marker, after which the crop was set. A cultivator was used after that as often and as long as possible. When seedlings were set in the field, the ordinary round dibber was never allowed to be used. In its place a flat dibber or a trowel was employed. The theory of this was that the ordinary farm hand would make a far deeper hole than was necessary, and with the round dibber this would result in an open space between the roots of the plants and the bottom of the hole, and that more than ordinary care in closing was required to prevent this, while with the flat dibber, the hole would probably be just as deep, but it would be more evenly closed, and even in a case where it remained, it would be so narrow that the plant roots would have but little trouble in spanning it, and hence the supply of moisture would not be disturbed.

In the setting out of young celery plants, the tops were removed, leaving only the young central leaf. This was enough to carry on the work of the young plant and give the roots a chance to become thoroughly fixed in the soil before being called upon for active work. It often happened that soon after these celery plants were set, dry weather would set in, in which case a wheel hoe was run both ways on one or both sides of the row, just as close to the plants as was possible. This gave a dust mulch, thus economizing what moisture was present and giving thorough aeration to the soil surrounding the roots. In the summer of 1909, the celery was set during a severe drought, when the soil became so dry that a total failure seemed probable. In order to save the crop, a barrel was mounted on a cart, drawn by one-horse. This barrel was provided at the bottom with a twin nozzle and hose on each outlet, long enough to almost reach the ground. The barrel was filled with water at a lateral pipe line which ran into the field, and was then driven through the rows, watering two rows at a time. This procedure was somewhat slow, and required one man and two boys, but the value of the crop was at stake, and, hence, was a successful method, since it saved what would otherwise have been a severe loss.

There was one other factor which made conditions on the farm adverse, and that was the surrounding social community. That vicinity was worked by small farmers of the proverbial type, uneducated, unscientific, going by traditions, and resenting an "outsider" who came in with new and modern ideas. This state of affairs made it hard to get help of any kind and made the social life there much more unpleasant for Mr. Schwarz than it should have been.

CELERY CULTURE.

By D. W. HULL, Waymart, Pa.

To say that I feel it a great honor to be asked to talk to you is stating it very mildly. I have never talked to an audience of farmers, except a few neighbors, when we meet as neighbors will. So I would like, to-night, to use the broader definition of "neighbor" that Christ gives, and that will include us all.

Perhaps I should say that I am not a market gardener in the sense that our President used the word, although probably we started in on that line. At this time we are celery specialists. I might say that the reason we are able to make a profit out of celery is because it receives our main time and attention; it is first with us. Now, we have about three acres each year of this, which brings us in quite a good deal more than our other 190 acres, and this is pretty good land to, as our meadows yielded over three tons of hay to the acre this last season. But the celery has not only been the main support of Hull Brothers, but is enabling us to set the rest of the farm to apples and peaches. This three-acre plot is a renovated swamp, drained about right for celery muck, but not quite enough for other crops.

The SECRETARY: Did you tile it?

MR. HULL: No; we don't use tile drains. The muck ground is so nearly level that we are afraid they would fill with the soft soil, or our horses might get them out of line, if they should sink in over the drain. It wet times we have to use mud-shoes on team; and to be sure of good drainage, we use open ditches; cleaning them out anew each spring.

roots, refuse, etc., from the celery cut there, and had been spread over this, making the yield seem wonderful to us. Amounting to the rate of nearly \$2,000.00 per acre on a small spot. This proved its possibilities, if we could only supply fertilizer in a wholesale way that would grow the celery as the celery-refuse did.

But at Waymart we gave notes for over \$9,000.00, while we were only worth about \$500.00, so we felt too poor to buy fertilizer for a few years. About this time my brother was very sick with smallpox, which cost us so heavily that we felt we needed to make strenuous efforts, so we fertilized celery and early cabbage much more than ever before, and in the fall we were better off than we had been any season yet, for all of our heavy expenses. So since then we have kept increasing fertilizer on celery.

Our main crop is Golden Self Blanching, which we start in a couple of small green-houses, built quite cheaply and heated by stoves. The seed is bought fresh each year from Henderson, because we think the new seed produces the most vigorous plants. This is sown in rows three inches apart with a "Eureka" drill, which is about right for greenhouse work, but the plow and coverer are taken off, so we can just barely cover the seed by sifting fine soil very lightly over the benches. We commence sowing about March 1st, finishing about March 20th. Our greenhouse soil is made up of loam, muck, sand, fine siftings from coal ashes, and manure. We do not sterilize it, because we believe the sun does during the summer, when it gets so dry and hot, so we just add humus in the shape of muck and manure, and use year after year. We fertilize with about 600 lbs. of Bone Meal, and nearly as much wood ashes, on nearly 2,000 sq. ft. of glass.

We try to get the soil in the benches just as level as possible, because if any higher spots are left, the water will run off of them, leaving bald spots, because celery seed must have plenty of moisture or it won't germinate. After leveling and packing, the soil is saturated with all the water it will hold, seed sown, covered, then calico curtains are stretched on wires about six inches over the beds. Calico proves better than anything lighter or heavier; and if it should be of a blue shade, we dye it red, because red will let the chemical rays of the sun through, while blue will not.

We do not let these beds get at all dry, yet because of the curtains, we only have to water a little before they are up, which is two or three weeks. The curtains are removed as soon as plants are up, and as soon as they are large enough to grasp, we commence thinning to about one-half inch in the row, aiming to have 100 plants per sq. ft.

Broadcast sowing is just as good, only but few men can thin as fast that way. The ground is kept stirred around them, and if the plants are too yellow, we water less, or if too dark green, it shows that they need more water. If not growing fast enough, we water with nitrate water, but we dilute this quite a good deal.

When plants are four inches high we clip them so they will make a stockier growth, and also a better root system. Clipping two or three times. About two months from time seed is sown, we try to set in the field, but we have to be careful and not set too early, because if they freeze much before the roots are established, it will kill them.

We plow this muck in the fall, if possible, and then in the spring cutaway it well, making it just as fine as possible. Fourteen per cent. dissolved rock is then spread on with the shovels from a stone-boat, using eight tons on the three acres. This is acmed in well, then a little over half a ton of muriate of potash per acre is sown on by hand.

EXPERIMENTS WITH CABBAGE AND TOMATOES.

By PROF. C. E. MYERS, *State College, Pa.*

The Department of Horticulture of the Pennsylvania State College and Experiment Station is making an exhaustive study of the three leading truck crops, viz.: cabbage, tomatoes and asparagus. The work includes seed selection, methods of culture, fertilization, variety and strain tests. Of these the strain tests are considered the most important.

In order that I may give a somewhat definite idea of the work I shall discuss each of the crops in order.

CABBAGE.

It is generally conceded that cabbage is the leading as well as one of the most profitable of the truck crops. It can be grown with comparative ease, and on a wide range of soils. To secure best results, however, the soil should be well drained, yet of large water holding capacity, and possess an abundance of readily available plant food.

In discussing the culture of cabbage it is well to take note of the general character of the plant. We note that the leaves are the essential part of the plant from the market standpoint. We also know that nitrogen is the element of plant food so essential in the development of that part of the plant, hence the need of an abundance of this element in the soil. Director Patterson of the Maryland Experiment Station has shown that ninety-eight and one-half per cent. of the cabbage head is water. Thus for every ton of cabbage sold we actually sell nineteen hundred and seventy pounds of water.

In order to secure and maintain a soil in a condition best adapted to the successful development of the cabbage plant the method of soil management previous to the planting of the crop as well as after it is planted is an important consideration.

We have already seen the importance of water to the cabbage crop. Experiments have proved that most of the water utilized by the growing plant is not that which falls during the growing season, but is the water that has been collected during the preceding months and held in the subsoil until the plant is ready to utilize it. We have also learned that the best way to collect and hold this water is by having the soil rich in humus, by plowing as early in the

spring as possible, and by maintaining a surface mulch on the soil to prevent loss by evaporation. Experiments conducted at the Wisconsin Experiment Station have shown that in the spring when the soil is wet, when its texture is close from the packing which has resulted from the winter snows and early spring rains, the loss of water is very rapid and may exceed twenty tons per acre daily, and this loss may extend to depths of more than four feet. Another experiment showed that when a piece of corn ground was plowed on April 28 and sowed to oats but little water was lost during the week which followed, while an adjoining unplowed strip only ten feet away lost during the same time one hundred and ninety-eight tons per acre. Furthermore, the land plowed at the later date was in a poor physical condition, and was with considerable difficulty placed in a suitable condition for plant growth.

The humus content of the soil may be increased by either of two methods; first, by the use of stable manure, and second, by the plowing under of green and cover crops. When it is possible to procure stable manure at a reasonable price it is probably the cheapest and most satisfactory way of maintaining the humus content as well as the fertility of the soil. In some sections of the country cover crops as crimson clover, cow peas, vetch and rye are used with excellent results in maintaining the humus content of the soil. They not only keep the land covered during a large part of the year, but they utilize available plant food which otherwise would escape and put it in a condition which may readily be utilized by the crops that follow. At the time of final preparation of the soil, care should be taken to thoroughly incorporate the vegetable matter with the soil. It is important that this be done or the capillary rise of water from the subsoil may be cut off and thus the end prevented we seek to obtain. It is well also to emphasize the importance of having the soil thoroughly prepared to a good depth just previous to the time of field planting.

SEED.

There is probably no more important question confronting the farmer to-day than that of good seed, and certainly none to which he should give greater attention. At the outset permit me to say that as a whole I consider the seedsmen to be a reputable class of business men, but there seems to be enough of the undesirable element present to make the position of the farmer an unenviable one, and one which frequently results in material financial loss.

The first point the farmer should consider when purchasing seed is the germinative ability of those seeds. Unless a reasonable percentage of the seeds germinate an unsatisfactory stand is liable

growth from the time the seeds germinate until the crop matures. In a test made during the past season of fall grown plants wintered in the open ground at White Marsh, Maryland, vs. spring grown plants secured from the same place, it was found that the spring grown plants were decidedly superior to the fall grown plants. A large percentage of the fall grown plants went to seed and quite a number of them failed to make any material growth, while the heads of those that matured were scarcely more than half as large as the heads from the spring grown plants. There was no material difference in earliness.

Experiments seem to indicate that the size of the plant at the time of field planting is not of much importance, so long as the very large and the very small plants are discarded.

VARIETIES.

A great deal might be said about varieties of cabbage. It is probable that there are several hundred so-called varieties listed by the various seedsmen, and each year the number is being increased. In some instances new varieties of merit are thus placed in the hands of the farmer, yet there seems to be a decided tendency to put out old varieties under a new name. It is interesting to note to what an extent this is done, as any person may prove for himself by planting side by side the seed of a number of so-called varieties of the same general type. Frequently too large claims are made by the seedsman concerning a particular variety, and in some instances these extravagant claims are accompanied by pictures to further impress on the reader the great value of the variety which in reality does not exist. In the testing of new and untried varieties my advice is go slow, and when making a test do it under the same conditions afforded the regular crop, and if possible in close proximity to it so that a careful comparison can be made.

During the past season we made a test of thirty-two early and thirty-three late varieties. In some instances the tests were highly satisfactory, and upheld the claims made by the seedsman from whom the seed was purchased, while in other instances there was no perceptible difference between several so-called varieties except possibly the extra price charged for the seed. In other instances they were old varieties under a new name.

It is probable that the one phase of the experimental work which most interests the person engaged in truck farming is the strain tests. In this work we have aimed to show the relative value of seed of the same variety from different sources. The work was begun two years ago with Jersey Wakefield and during the time that has intervened some interesting results have been secured. In some

cided importance. In some instances substitution of varieties were noticeable, and where this is knowingly done by the seedsman without the knowledge and consent of the purchaser that seedsman merits all the adverse criticism he may receive. An interesting feature revealed by the tests is that in many instances the plants which appeared the most promising during the first part of the season later became the least valuable. The results of these tests are published and can be had by applying to the Experiment Station, State College, Pa.

The insect injury to cabbage is worthy of note. Two classes of insects attack the plant and either may cause considerable trouble. The cabbage aphis or "louse" may appear any time and if not combatted may frequently cause serious damage. It may, however, be readily held in check by spraying with a ten per cent. solution of kerosene emulsion or with some good soap solution. This application should be thorough and particular care should be used to destroy the insects clustered about the growing center of the plant, for unless this is done the plant will not develop. The "cabbage worm" usually appears about the time the crop begins to head, and destroys the plant by eating holes through the leaves and head. It may be successfully combatted by a spray composed of one pound of arsenate of lead dissolved in one hundred and fifty gallons of water.

There are also several cabbage diseases which sometimes cause serious trouble, of which the black rot is the most important. It may be recognized by the discolored blotches along the margin of the leaf and by the black spots in the cross-section of the midrib. It is a bacterial disease and there is no known remedy for it. It may be held in check by destroying by burning the infected plants, and cabbage or allied crops should not be planted on infected soil for a period of several years. The heavy application of lime to the soil is said to be a benefit in preventing the disease.

TOMATOES.

What has been said concerning the soil conditions for cabbage is largely true for tomatoes, except that less nitrogen is needed. Here we are dealing with a crop in which the fruit is the essential part, and an excess of nitrogen tends to produce a large growth of vine and soft, watery fruit. This being the case we need a fertilizer containing less nitrogen but more phosphoric acid and potash, and particularly the latter. It is impossible to prescribe a fertilizer which will apply to all soils, but in general we may say that an application of eight to ten tons of stable manure to the soil the preceding fall, well worked in, and this supplemented by about five hundred pounds of a 4-8-10 fertilizer in the spring at the time of planting should give good results on a wide range of soils.

The handling of the plants previous to the field planting is an

it is transplanted until placed in the field, and is an important factor in securing early fruit as well as an even stand of plants, since by this method the plant sustains no shock in being transplanted. This point is especially noticeable in case the ground be a little dry at the time the field planting is made.

VARIETIES.

What has been said about varieties of cabbage is generally true about tomatoes. Last year we made a test of fifty-nine so-called varieties. In some instances the varieties were new and distinct and worthy of a careful trial by all engaged in the culture of this vegetable, while in other instances it was impossible to distinguish the so-called new varieties from well-known old varieties.

The strain tests were conducted on the same plan as with the cabbage and included the various Earliana, Chalks Jewel, Matchless, Beauty, Globe and Stone. The first three named varieties have been tested for two years, and some interesting results have been secured. For these tests ten plants of each of twelve strains were compared. The results for two years show that the yield of Earliana has varied from eight to eleven and nine-tenths pounds per plant. This would mean that should we set the plants three by four feet apart in the field there would be a difference in yield of the two strains of seven tons per acre. A similar test with the variety Matchless has shown a variation in yield of from eleven and one-tenth to fifteen and three-tenths pounds per plant, which would result in a difference in yield of five and seven-tenths tons per acre were the plants set four by four feet apart in the field.

Little can be said as to the best way of securing the high yielding strains. We must, in a large measure, depend on the integrity of the seedsman from whom we secure the seed, and it is well to purchase from several. In general, it may be said that it is well to secure a variety from that seedsman who introduced it and who considers it as one of his specialties, since in that way we are more likely to get seed of known value than when it is purchased from a dealer who has no especial interest in the variety.

MARKETING.

An essential point in profitable tomato growing is the marketing. When the crop is grown for the cannery this point concerns us but little, but where the plant is to supply a basket trade the question is decidedly different. To handle the crop in the most profitable manner requires a careful study of the market, and it is probable that specific directions cannot be given which will apply to all places and conditions. There are, however, a few points which are general in their application.

In the first place the crop should be graded and put up in an attractive manner. The fallacy of putting "new wine in old bottles" applies equally well to tomatoes as to wine. Unless the package presents an attractive appearance, even though the goods be of a high grade, it will not bring the best price. A second consideration in marketing the tomato crop is uniformity. Where a high price is expected the need of having the fruit run uniform in size and color is an important one. Where care is taken to produce early fruit of good quality, and put it up in an attractive package the tomato crop may be made to yield handsome returns.

LIST OF OFFICERS OF THE PENNSYLVANIA DAIRY UNION FOR THE YEAR 1910, WITH ADDRESSES DELIVERED AND PAPERS READ AT THE MEETING OF SAID ASSOCIATION, HELD AT PHILADELPHIA, FEBRUARY 2, 3 AND 4, 1910.

THE PENNSYLVANIA DAIRY UNION.

OFFICERS FOR 1910.

PRESIDENT.

W. E. PERHAM, Niagara.

VICE PRESIDENT.

J. G. REIST, Mount Joy.

SECRETARY.

PROF. H. E. VAN NORMAN, State College.

TREASURER.

W. D. MARSHALL, Lyndell.

REMARKS BY THE SECRETARY, PROF. H. E. VAN NORMAN.

Mr. President: In planning for this convention of the State Dairy Association, or Dairy Union, as we call it in this state, with that of the Livestock Breeders' Association, it was our wish not to lose sight of the fact that the dairy industry, as a whole, is a very large industry; that it has many distinct branches; and if you look the program over, you will see that each day, or each half-day of it, has its own problems; and it was felt that in coming to a city like Philadelphia, it was possible to have a discussion of some of the problems of vital interest to the distributor of milk; and that we could have a meeting at which the dealers from other towns would be interested in discussing the problems with the dealers from the city. Philadelphia has a live Milk Dealers' Association; they have their own meetings; but there are other dealers in the State, and we hoped this session would draw some of them out at this time and give room for a discussion; and so that was the reason why this session has been set aside for the dealers. There is too much to be put into a three-day convention to have it all at

one meeting; and, therefore, we have the producers and the live-stock people gathered together at Houston Hall for a discussion of problems relating to the growing of crops for the dairy.

I invited Mr. Logan Harding, of New York, to speak to this meeting. We invited Mr. Thomb, of the Johnstown Sanitary Dairy Company, to help in starting the discussion and, as happens to many business men, their plans were changed after they had signified a willingness to help us out, and both of them wired me that they would be absolutely unable to be here; but I felt that we should have a meeting anyway. I turned to Mr. Woolman, in my dilemma; and through his co-operation we have Mr. Schier, of Baltimore, who has jumped in to grab the falling stick and help hold it up until we can get something nailed down good and solid; and I am sure that we will all feel indebted to Mr. Schier for coming here and helping us out. You know a "prophet is not without honor save in his own country," so we tried to get out of having a prophet of our own and getting one here whom you would listen to.

To-night's meeting will be a memorial service down at Houston Hall. To-morrow morning's session will be demonstrations in cattle judging, and some display. To-morrow afternoon will be a meeting at Houston Hall of the producers. There the problems of milk production will come up. To-morrow night was scheduled for a banquet; and that matter is a little uncertain, because banquets seem to come high in this part of the State; and they say, with the high cost of food and the small profits in the city milk business, the probabilities are we couldn't get a large number together at a high-priced banquet; and that matter has not been settled, but announcement will be made to-morrow.

Friday's session will be a double-decker; that is, there will be two meetings going on all day. In the morning and afternoon the butter makers will have one room here, and the Livestock Breeders' Association will have the other; and if you follow the program, I think there will be no difficulty to find something that you are interested in listening to. The Milk Dealers' Association came here because the school offered better facilities for the livestock which no other part of the State did; and while it is not ideal in some of its parts, we felt that it was worth while—that it would do the associations good and do the schools good for us to get together; and I am sure the Dairy Association is indebted to all who have helped to make this convention whatever it is and may be.

first of it; there was not much chance of doing much thinking and much preparing for this meeting; but I feel sure that anything in this line, in coming together as you gentlemen in Philadelphia had been doing in your exchange for so long a time to the great admiration of us fellows down in Baltimore, helps to bring better conditions about; and we just had an example of that in Baltimore, when we had our first milk contest in December.

We were able to get 3 samples of milk together which, as a whole, scored extremely good, and have awakened in the farmers a great deal of interest in the production of sanitary milk. We are all the time after them to give us good sanitary milk; but it seems to me we need continuous work to have it right. We were fortunate enough to get some very nice results there, some very low count bacteria milk, which is, after all, the most important thing; and I am sure that this line of work will always benefit everybody connected with it, the farmer and the milkman at the same time.

I tried to prepare a little paper this morning, and took as my subject to talk upon the work which the milk dealer can do to promote the scientific end of this business, and especially in regard to sanitation; and with your permission I will read that.

(Reads paper which was not furnished.)

The PRESIDENT: Now we are ready for questions, and we have had a good paper; we want a lively discussion on it. In asking questions, please give your names, so that the stenographer can get it.

MR. SCHIER: The straining cloth which was used, and which I stated in my paper I always had suspected of being the source of contamination, was apparently a clean strainer cloth, such as you would find at the average farmer's. I have traveled now for twenty-one years over farms in Germany and in this country, and have made quite a close study of our work. I have found that the farmer is willing enough, as a rule, to do the right thing; but he has not the facilities to do them as they should be done, and especially when it comes to bacterial cleanliness. He washes his strainer cloth and his utensils, as he believes, fully sufficient, fully good enough for us to give us a clean milk. He thinks, when he sees a strainer cloth white, that it is clean. Bacteriologically it is certainly not clean—it is absolutely not clean bacteriologically except it has been thoroughly sterilized and scalded. There are a great many farmers who can not scald their things just previous to the time when they should be scalded, right before the milking; and while I do not contend—I do not want you to feel that this cloth which I give to them is a survival—it is not; it is handled in the most careful manner by Johnston and Johnston and prepared just like all the other well-known sanitary goods—at the same time it is not an absolutely sterile cloth; but it certainly stands an entirely different test than those strainer cloths you find at the farms. We got similar tests at some dairy farms where we have extremely careful men who do scald their strainer cloth, and there we did not find just before they put their milk through such condition; but where the strainer cloth is not scalded, it certainly offers the

very best harboring place for bacteria, and they certainly will be found in over ninety-nine out of a hundred strainer cloths, I assure you that.

MR. WILLITS: We have proven that the ordinary cheese-cloth strainer does not do its work. We substitute in its place a cloth very similar to this Johnston's Red Cross filter cloth. I use the ordinary poorer quality of canton flannel, straining through the fuzzy side up. That is the way you strain yours?

MR. SCHIER: Yes.

MR. WILLITS: I have found it very efficacious, much more so than the cheese-cloth, very much more inexpensive. It can be had at most any store; and nearly all the people that ask us about strainer cloth we advise to buy, rather than the cheese-cloth. Do you know anything about it?

MR. SCHIER: Yes, I do. In this experiment in my endeavors to get a material suitable to be placed in the hands of the farmers, our thoughts were naturally directed to canton flannel, also. The canton flannel is all right, as far as the first straining is concerned; but I think you will find it just as expensive as this goods. They are not handled when manufactured as carefully as these goods are handled. Canton flannel you can wash, and do wash, I suppose, at the farm; but don't you see, the very thickness, the very heaviness, is just double—threefold as much against the use of it than in the strainer cloth. The strainer cloth is not so heavy but that it can be washed clean; but the difficulty is, they can not get it clean with the facilities they have at the farm, and therefore we find that we must give them a material cheap enough to place a disc in their hands for each and every milking.

We made some experiments at home; and we are now filtering our milk, after it reaches us, through the same material. We are using a filter 7 ft. long by 20 inches across—a cloth 7 feet long by 20 inches wide, and filter our milk; when it comes from the regenerator it is heated to 144°. That makes it thin enough to let a large quantity of milk run through the cloth; it gives us a very clean milk. Now, since we are using this cloth at our farms, we don't have even the discoloration, hardly—a discoloration of our filter cloth at home. We do find some specks there, which may be due to having gotten on the can just before it is strained—the man just simply had neglected to close it before a wind-gust blew a whole lot of little pieces of straw and hay and all kinds of dust on to it, and the can had to go back; but I am just as sure and satisfied that that milk was clean otherwise; that it had been contaminated after it had been strained. We took some of those strainer cloths which we had there and washed them to see what we could do. We could get them pretty clean to the eyesight; but I am satisfied that they were not clean bacteriologically. They could have been gotten so if they had been thoroughly sterilized afterwards; but the high heat necessary to sterilize them simply makes so tight a fibre—got so much closed up—that it would not do filtration for a very long time. It is by no means the perfection in filtration, but it certainly is a great step beyond the use of the cheese-cloth. No doubt about that.

MR. FULLER: May I ask if you consider those as good as any other method?

MR. SCHIER: I said in my paper distinctly that I do not. I consider it most vital that the narrow-mouthed milk filter be used; but I do not know what the experience of you gentlemen here in Philadelphia has been. With us in Baltimore it has been distinctly unfavorable with the dampness. We simply believe it is impossible to milk in a copper pail. The copper pail will do very much more good than any strainer cloth we can use. The vital point is to keep the bacteria out in the first place; but as long as we can not get that, I say it is best to have something that will take out as much of the undesirable matter as we possibly can get out; and I have not found anything so effective as this cloth which I have shown you gentlemen here to-day; and I also say that the very necessity of straining the milk through this cloth while it is still warm, just as warm as it can be, is of great importance; because the moment it stands for a half-hour, it is almost utterly impossible to even get five gallons of milk through that strainer cloth, because it will not go through; and therefore, again, the foreign matter is taken out just as quickly as it possibly could be done after the milk has been milked; and that is the vital point of it.

Glad to have you ask any other questions, gentlemen, if there is any thing of interest to you. Speaking of not having the metal cloth in that strainer, you see one of the greatest difficulties in cleaning a strainer is removed. It is nothing but practically a straight through opening there; and when you ever have looked carefully at one of those strainers, even by your careful farmer, I am sure you will find that those—either the perforations, or the metal gauze—were not by any means as clean as you would like to have.

MR. GRISCOM: What do you think of clarification of milk?

MR. SCHIER: Clarification is all right as a means to take out some of the dirt which should not be in the milk. It is one of those steps that the dealer has to use to get results. Also, since I have found this material so effective, I have given up clarification fifteen months ago, and really had very much better results than with clarifying. I mean to say clarifying gave a beautifully clean milk—it must, under the conditions under which we had to work (the best kind of milk we could have); but it also affected our cream considerably. Since we have given up clarifying the milk and used what we considered the best machine for clarifying—that is to say, the machine with an enlarged cream outlet, so that the cream

on the first day of December, and Mr. D. P. White, of Washington, scored the milk there. We were delighted to see that Maryland really could give us good milk. We had very nice samples coming there; but he made this remark (I do not repeat this to flatter myself; I am sure you will believe me when I say so; but simply to illustrate the point that I want to make in regard to this cloth.) He said that he was very glad to find the milk supply of Maryland, of the city of Baltimore, from the farmers to come in in such a nice shape, so rich and with comparatively low bacterial-content, and with such excellent flavor; but he also said that he was surprised that the majority of the milk was absolutely pure—that each and every one of the samples had dirt with the exception of the samples which were sent all to one dairy in Baltimore; and when I investigated, when I asked that dealer to whom this milk usually goes, how he accounted for it, he showed me that little bottle that I have there a minute; when I understood how it was that he could get that result. He made the statement that all the 11 samples of the 11 farmers who entered into the contest from our dairy and 4 of which took prizes, were strained through this cup; and the result was that not less than thirty-five farmers—thirty-four farmers—went out and bought immediately on the floor some of this filter—came out and bought the cloth. So it seems to show that it was worth while anyhow to go into that trouble, as I suggested.

R. L. SMITH: What do the 9 in. square cost per thousand; and whether any firm is now manufacturing the metal strainer cloth.

MR. SCHIER: The metal strainers are manufactured by a friend of mine in Baltimore, Mr. E. A. Kessner. There is no patent connected with it; you can have them manufactured anywhere you please; but he has, under my instructions, learned to be a very careful man making sanitary dairy products; and he is manufacturing this. I would be very glad for you to communicate with him, 516 Calvert street, Baltimore, is his address. The cloth is bought by the pound; the price which Johnston & Johnston puts on them I really don't know. I buy it in very large quantities; we buy never less than for 250 to 300 for dealers at one time; and that, naturally, has given us a special price; because we are, as I said a little while ago, supplying the farmer at our cost. We send them on the 24th day of every month a little box containing 65 of these discs; and that is entirely at our expense. We fortunately can get them out to them by putting a 5-cent stamp on it to carry it out—a 5-cent railroad stamp on it to carry it out to each station. If we have six or seven farmers, we bundle them all together, and it costs us just 5 cents to get it there; but we are sure that while the aggregate expense, the total amount of money spent, is quite large for those discs, I am sure that we are well repaid in having it; because certainly our milk has come in beautifully clean; and that is a great satisfaction to us to know.

HOWARD SHIVERS: Have you ever tried milking through those cloths?

MR. SCHIER: Yes. One man tried it; and that small amount of milk which he got through the cloth was beautifully clean. But I am afraid it will never be possible to do that for commercial use. It

is all right for certain work where you get your own price. We must not expect too much. We must make both ends meet. As it is, it is quite an expense to us to supply that cloth. I just had to write one farmer yesterday—the very one I told you had the can of milk going back because I found some dirt floating on the top of his milk; which possibly would not have been there if he had not exposed it afterwards. That dirt never could have come through his cheese-cloth which we found on top of the can; so he wrote for us to send him an extra supply of strainer cloths—that he was going to strain the milk a second time. We wrote him back that we could not stand that expense.

I believe that the plan of Dr. Norton, in New York, is an excellent one, where it can be done. The Maryland conditions are not of that character. I think you, gentlemen, here in Pennsylvania are closer to that than we are; and that is, to supply the farmer with proper milking vessels, or copper milking pails, sterilized properly at a certain place at your creameries. A great many of you men are getting the milk from a collecting station. In Maryland, it is not known at all; we have all individual farmers; and it would simply be a matter of impossibility to supply them every year with utensils; but where a farmer comes to a collecting station, he can be supplied with sterilized vessels there; and that, I am sure, would give you excellent milk, and is one of the best plans that I ever saw; and it would mean that you must have a careful man at your collecting station, a man willing to enter with full heart and soul into that work, and that you would have to provide yourself with proper facilities of doing the work quickly there of sterilizing each man's cans and vessels to milk in.

As I understand it, the idea is that you have vessels just large enough to hold probably the milk of one or two cows; and the milkman comes and brings the milk from that pail to the creamery immediately after being milked, without even being cooled—the morning's milk; and the evening's milk is set into special vessels with cold water, to be cooled there, and it is taken the next morning.

Besides the strainer cloth, there is no doubt in my mind that the milk can is one of the greatest sources of contamination in the milk, undoubtedly very much more so than even the poor milk; although the poor milk, as I said awhile ago, undoubtedly has a great deal of effect in all the milk now produced. The farmer hates to throw away those few drops of foam milk.

The PRESIDENT: I would like to hear from Mr. Woolman, President of the Philadelphia Milk Exchange.

ADDRESS BY MR. WOOLMAN, Junior.

Mr. President, you called upon Mr. Woolman, President of the Milk Exchange. I am not president of the milk exchange. The president is here. I don't know whether you mean him. I will resign in his favor if I can catch his eye. Or, whether you meant my father, but anyway I will try to take up a moment or two.

In relation to the can being sterilized in New York and returned to the farmers, last May I attended a meeting of the Pediatric Societies at Atlantic City, and Dr. Darlington, who was then President of the Board of Health of New York city, told us a story of the washing of cans. He was walking along a street in front of a dairy with one or two of his inspectors, and he found two or three hundred cans piled up there in front of the place. He looked at one of the cans, pulled the lid off and he pulled back from it, he didn't like the odor very much; and he sent his inspector back to the laboratory; he waited around the corner. I don't know the name of the stuff he sent for; anyway, the inspector came back, and they very quietly sprinkled a little of this stuff into probably fifty empty cans; those cans were shipped back to the farmer, and the milk inspectors were told to be on the watch; and about three days later fifty cans of beautiful pink milk came down to New York city. He had sprinkled in these cans some coloring matter of some sort, and it colored up that milk so that it was absolutely worthless. Of course, it struck me that it was taking pretty drastic measures to correct the non-can-washing evil; but it should be clear that some cans in New York were not being washed. Fortunately for the production of milk, New York city is taking—has taken—a stand; and there is a law, I believe, which allows New York city to send out into the country inspectors.

Dr. Darlington, to go back to another one of his stories, said that they had gone up into a corner of Pennsylvania and had struck some conditions on the farm they didn't like very much, and they tried to persuade the farmer to correct them; and the farmer said, "Well, we live in Pennsylvania. What are we doing? You are a New York inspector, are you?" "Yes," he said. "What are you doing here?" "Well," the inspector said then, "I was down South once; I went out into a field, and along about noon I heard a bell tolling; and so I asked what it was; and they said dinner was ready. So I started to walk up towards it; and as we got up towards this bell, there was a dog alongside of the man that was pulling at the rope; and he lifted his nose up in the air, the dog did, and started to howl, too. The old darkey stood it for a little while. He said 'Oh, you shut up! you don't have to eat it,' and that is what the Doctor told these farmers of Pennsylvania—that they didn't have to drink the milk that they were producing, that the New York public were drinking it; and they, I believe, have gotten very good results through the inspection in the country. I believe that Philadelphia has either no law and no money to support the inspection in the country; but I think it will be a benefit to every one if we ever get such a law as that, and that producers should not look upon inspectors as coming out to enforce law, but look upon them as though they were helpers and educators, and take their instructions correctly; and I believe that if we can get inspectors that have had some knowledge and have had some training, as the chief of the Dairy Division of the United States government in the Department of Agriculture said—Chief Rau—I believe he said they wanted men that were experienced in such matters, and men that had had some training; and I was very pleased to hear that at the State College the dairy course was one of their largest courses; and we

need it, I know, in the city; we need men in our bottling plants that know something and have had some experience; and I hope we will all help along as much as we can in the movement of the dairy courses in our colleges.

The PRESIDENT: Any others now? We would be glad to hear from Mr. Woolman, Sr., if he is in the room.

ADDRESS BY MR. WOOLMAN, Senior.

The members of the Philadelphia Milk Exchange and other milk dealers in Philadelphia know that I am not a speaker who can talk as well as some of the others have; but the experiences that I have gone through, having been some sixty years in the business—are being realized to-day; the introduction of bacteriology, the introduction of the testing of milk. Twenty years ago, when the Milk Exchange was first formed, the men at the depot used to send word by men—depot men—to know what solids in milk meant. The average milkman in Philadelphia didn't know there were any solids in milk. Now, we have been progressing since then; we have been enabled, by the testing of milk, to get the specific gravity, the amount of fat in it, to have a control of the quality of the milk. Now comes bacteriology, that shows to us the impurities that none of us were actually aware were in the milk.

I am very certain that in the past year we have made a wonderful progress by having our milk bacteriologically tested constantly. We are learning more about milk than we ever knew before. We are getting down to the bottom of it. We are beginning to find that milk, in order to be good and clean, must be produced so as the dirt never gets in it; that is the foundation, that is the beginning. If we can get milk that is produced sanitarily, I mean as it should be produced and as it will be produced in the near future; because we are going ahead rapidly; we are going faster in the milk business than almost any business that I know of. There is more money in it, ten times more money invested in the milk business to-day than there was ten years ago; with the investment of more money people are enabled to get better results; they can go further, they can do more; and the only criticism that I have to make on the friend from Baltimore is, that he has told us how to get clean milk, but he has not told us how the farmer is to get more money, and how we are to get more money. The vital question to the milk dealer is, to buy milk cheap enough and put so much expense on it or so little expense on it that he can sell it at a profit. Now, the expenses of carrying on the milk business to-day and delivering to a family a pint of milk a day, perfectly good and nice and sweet and clean, is impossible at the price to do it. Therefore there must be some education along some lines by which the business can be made to pay the farmer and to pay the dealer, to give him an interest on his capital, to pay him for the expense of delivery, so as we can all get a fair living profit out of it.

The PRESIDENT: I would like to hear from Mr. Harbison.

ADDRESS OF MR. HARBISON.

Mr. Chairman, I thought possibly that I would simply be a listener. The question in my mind on the milk supply is, is the public willing to pay the price? There are two kinds of milk to-day, sold in the City of Philadelphia: One that is produced under fairly good sanitary conditions, by painstaking industrious farmers; the same milk sold by painstaking industrious milk dealers under good sanitary conditions at 8 cents per quart. The other is milk sold, at least produced by farmers in some kind of a stable, from some kind of a cow, fed on some kind of feed, sent in some kind of cans, filled in some kind of bottles and sold at the same price as the other kind of milk. Now, when the people are not able to test and to say which kind of milk they wish and are willing to say that both of those kinds of milk are worth the same price, you have a question to convince the public which milk they should buy. In this city, the same as to milk that is coming into the city, at least 75 to 90 per cent. of the milk is reasonably safe, reasonably good food; but the remaining per cent.—I would be ashamed to say that it is sold as an article of food. The Pennsylvania legislature passed a bill to license milk dealers in the City of Philadelphia; that bill probably some day will be enforced—put in force. If it is, the dealer who has these slipshod methods, the man who collects the bottle off the door-step makes no attempt to wash that bottle, to sterilize that bottle—will simply throw that with a number of others in a can and without washing his hands or anything else go in that can for these bottles; it is a daily occurrence with some of these people on the street to see how they fill their bottles—pick up a bottle off a door-step and simply pour some milk in out of a can; hold it to the lip, if there is a little froth, blow it off; hunt all around the pocket for a cap, put it on and take it in to a woman. She will pay just the same price for that milk as milk delivered under the best sanitary conditions.

Another question: To my mind two items should enter into the selling price of milk. One is the value of the milk itself; and the other is the expenses of delivering the milk. In this town, unfortunately, people who purchase a quart of milk receiving a pint of milk early and a pint of milk late, compel the dealers to make two deliveries—absolutely no reason for it. If those people would simply take a quart of milk in one delivery, it would save two expenses to dealer. The initial cost of a bottle, whether a pint or a quart, is nearly the same. The washing, the filling, the capping, the delivering—whether a pint or a quart—is practically the same. It stands to reason that if the public want two deliveries in the one quart of milk instead of one quart and one delivery—that if their attention was called to it, they would assist the dealer considerably by reducing that item of expense. I think the solution there is for us to sell more milk per wagon by the public buying in larger packages, enabling us to pay a greater price to the farmer. There is no question that the producer who goes to all the trouble and all the expense as suggested by our Baltimore friend—his milk ought to be worth more money than the man who absolutely does nothing. If the public will support and purchase only milk that is sanitary,

the dealers and producers who are going to this trouble, going to that trouble, will be able to furnish that higher degree of milk and do it without practically any increase, or comparatively little increase, to the public.

ADDRESS OF PROF. VAN NORMAN.

I am not on this program, Mr. President; but I want to suggest my viewpoint on some of these questions in connection with the different bacteriological counts. It is true that many of the bacteria in milk are not in themselves objectionable; but the fact remains that wherever we find large numbers of bacteria, whether they are evil or not objectionable, we usually find neglect in the handling of the milk, either in the lack of cooling or in the lack of cleanliness; so that after all is said and done, the fact remains that the number of bacteria are an index—the best index we yet have; not necessarily perfect, but the best we yet have—as to the conditions under which the milk has been handled or the temperature at which it has been held. Now, then, these contests were made out of the shippers' cans as they arrived at the platform; and it was assumed by the committee in charge that that would be much more nearly representative of the kind of milk the dealers were getting from the farmers, than it would be to send out to the farm 4 bottles and let the farmer fill those bottles in any way that he saw fit. The man who knows bacteriology and knew how to get a perfect sample, might get a very fine sample and yet get a very poor milk into the city.

Now, I may say that personally I am very much gratified, as I glanced over the reports so far in, to find so many of the lots running below 10,000 as taken by the milk inspectors at the platform out of cans shipped in. This method was used. The man who wanted to compete, notified the committee that they wished to compete; and they didn't know what day—whether Thursday, Friday or Saturday—samples would be taken; so that the cans were not specially prepared. If the man sent two or three or four cans, they didn't know whether we would take it out of this can, or out of all the other cans; and the fact still remains that that milk is still subject to the contamination of dust at the time when the sample was taken; because it was taken either on the platform, or in a bin, or somewhere. Now, their danger is perhaps not large. If it was a rainy day, or if the air was damp that day, there would be practically no contamination. I don't know what that day was; but that was

In that solution there will be some who will have to drop out because they can not play the game and win; they will be forced out. Now, as a matter of fact, our dealers have invested a large sum of money in their effort to distribute the milk in a way to get the milk to the people in the best shape they know how and to make some money for themselves. The farmers have invested in their farms and cattle a considerable sum of money in order to produce the milk, market it and make a living for themselves. Then, there seems to me, as far I discover it—I am a college man, I don't belong to your gang, either of you, so I can look at it from the outside, unprejudiced by the dealers' viewpoint (I am not a dealer), unprejudiced by the farmers' point (because I am not a farmer); and, of course, in spite of all these things, I am not practical; therefore, I can simply look at it from the side, and ask that you look over these things. There seems to be about as much human nature on one side of this game as the other. The dealer tells us here this afternoon how inconsiderate housekeepers are. I have been in the milk business—milked the cows, washed the bottles, collected the bills and kept the books; and I know something of the weakness right along the line. The fact remains that Mrs. A., whose husband counts his money by the millions, can not afford to take 8 cent milk, or 9 cent milk: she can go and take 5 cent milk; she has got to save that man's penny or 2 cents. She don't know anything about the difference in the two; but that is the reason they are rich, because they have learned how to economize; but the wealthy consumers are lots of times the ones that are kicking more on the price they pay for their article; and yet the fact remains here that the consumer don't know the difference and many of them who do know won't pay for the difference. They steal the bottles which don't belong to them. We have got that condition to deal with; it is there; we can not change it all. We have got the newspapers' mistaken attitude. Even the dealers are not all perfect. We talk about a trust, combine or co-operation; and yet the dealers got up here this afternoon, and the statement was made that a part of the good that might be accomplished is spoiled because some dealer insists on going out and taking the bottle which Mrs. A. has sent half-washed and taking it into his wagon and filling it out of his can; so the dealers are not all perfect. If the dealers were all perfect, they would take those bottles all back and have them sterilized. There is no body perfect. I spoke to a farmer, Mr. B., milking five cows; he is feeding them \$60.00 to \$90.00 worth of feed a piece; let us take it \$75.00; he is feeding each of those cows \$75.00 worth of feed; one cow is producing some \$150.00 worth of milk; and the next cow is producing some \$50.00 worth of milk; and he is a keen, shrewd farmer—don't know which the cow is (which he thinks he does); but when it comes right down to the dollars and cents, and the lead pencil, a whole lot of our farmers that are kicking don't know which cow is not paying him. The result is, the \$50.00 cow is putting a burden on the others; and the profit he ought to have on his business off of the \$150.00 cow, is going to carry along the other cow.

The dealers are shrewd; they have to be to live in a city. The city is a kind of a wicked place: they tell us fellows in the country, "You have to be careful when you go to the city!" and the dealer who has succeeded in forty to fifty years, has had his own troubles to deal

with; but I suspect, when you come right down to it, he knows more about what it costs him to deliver that milk and wash the bottles and buy new bottles and pay for bookkeeping and never have losses: he can tell you nearer that than the farmer can tell you in his business. He knows the costs of doing business and he knows where the profits are.

Speaking from the farmer's standpoint, I believe the time has come when the farmer has got to study cost and do what the dealer has. The dealer has studied to find out where economies can be made. He can not force up the price; then all he can do is to reduce the cost of handling that milk so as to instead of having one wagon going to half a dozen houses, he goes and combines and two or three dealers go together. That is the way our companies have grown up in the city. Back in Milwaukee, where I have been this fall, three milkmen, who used to run a half-dozen wagons—every one of them customers in the same block—formed a company; and to-day they deliver nearly all the milk in the city of Milwaukee, and they got whole blocks where they deliver the milk to every house; so that one wagon, then, serves these ten houses in this block, instead of having ten wagons each going to the one block. That is a business economy which has resulted from the condition which the dealers had to contend with. I believe yet that out of this problem is going to come a still further economy. I don't know just how it is going to come; I hardly dare risk a prophecy as to how it shall be done; but I believe greater economies are to and will have to be—I know they have got to be and will be—from the farm end of it.

Here is another side that should not be lost sight of: the dealer is distributing 40,000 quarts of milk a day; I think most of them would be happy if they had $\frac{1}{2}$ cent profit on every quart of milk. I suspect the farmer thinks he gets about 3 cent profit. I question whether he does or not. I know just enough about it to know that he doesn't get 3 cent profit. If he had a $\frac{1}{2}$ cent profit on 40,000 quarts of milk a day, and when I say profit I mean above every thing—after he has paid an interest on his investment, but all the expenses—he would have \$200.00 profit, would not he? Why? Because he is delivering 40,000 quarts. But take it around to the farmer: will the farmer be satisfied with a half-cent profit? If he had a half-cent profit and he is milking 100 quarts a day, what does his profit amount to? He has got 50 cents a day profit, because he is only producing 100 quarts. That is a fundamental principle in business that we all have to recognize—that a small margin on a large number of dollars or a large turnover, often means wealth; where a large profit on a few dollars worth of business won't mean wealth. I don't know just how you are going to apply it; but I am satisfied in my own mind that we have got to recognize that principle; and if our farmers get together and organize to take advantage of fundamental business principles, we are going to get along any where better than we are getting, till sooner or later we get somewhere. We can not arrive at this simply by calling each other names: we have got to go at the troubles and get at the truth, because they will not be settled until the truth is arrived at.

I sometimes think that when Carnegie goes around the country giving his public libraries, he could really have done the public more good if he would have increased the wages of his employes a few cents

to each man, and the wealth would have told on the employes. Then you come back and say, "What, then, would fifty cents on a manager's salary to each one of those men have amounted to?" On that man it probably wouldn't have amounted to very much; and yet to Carnegie, when he took that manager's few cents, it meant to him the difference between rich and fabulously rich; and so in the milk business, the difference between $\frac{1}{2}$ cent and $\frac{1}{8}$ cent profit to a dealer distributing two or three hundred thousand quarts a day may enable him to ride in automobiles and pay five and six hundred dollars salaries; and when that is done, it sometimes makes the farmer wonder how big the profits must be on his side. It is because he has a very small profit on a very large amount of business. If this congressional investigation that we have heard so much about, results in showing us that there are economies that can be effected, that the margin has been a little bigger than is fair, and that the dealer has succumbed to the human nature that is in him and has taken advantage of his situation and gotten a little more profit than he ought to get and than he can afford to do with, that will all be righted and you will come out; but we can not get away from this fact: every one of you who stand or sit here to-day would be very glad to get into some sort of a combine that would enable you to count your automobiles by as many as you count your horses; and the reason you have not got them, is not because you would not take them—is because you have not been endowed with that measure of ability that has enabled you, in spite of all the conditions that you have had to contend with, to overcome those conditions. We have got to recognize that: and while it is true there are men get into positions where they have a chance to pinch the rest of us a little, we must not forget that most of us would be willing to do a little pinching if we thought we could get the results, too.

When we get a chance to see them, we do them. The Grange and the Society of Equity—what do they do? They complain about the trust; but just the minute their trust is strong enough, they turn around and do the other thing. Look at the tobacco growers down South! The Society of Equity tried to make dollar wheat; and when we got dollar wheat, a man told me the other day in Chicago—he said, "I made up my mind I would hold my wheat until it went to \$1.25; and," he said "there is enough of farmers holding their wheat so that the wheat has not all gone into the market and glutted it;" so human nature is pretty well distributed all around. The farmer has got to study his business and his costs, and eliminate the wastes; and I believe the dealers who are howling about the lack of profit in their business have got to hunt for the economies, too; and I sometimes think if the economies are effected that are proposed, they can do a little more; but the solution will come, gentlemen, finally, in a disposition to be fair to both sides, and to hunt for the real truth, not what appears to be the truth, and I believe out of all this theory will come the right method.

I believe firmly that milk is not going to be produced as cheap in the next ten years as it has been produced in the last ten years. I believe there are men producing milk who are going to have to go out of business, simply because they cannot produce it under the present conditions; I believe there are dealers who are going to have to go out of business, because they can not meet the conditions we

have got; and I believe there are others who, because of their superior measure of ability, and perhaps because of some fortunate circumstance, are going to go on and grow rich. We have farmers and dealers who are working, but they are not all making money. We have got to keep on studying and keep on agitating and looking for the truth; and I believe that out of it will come a solution fair to all; and I believe we have got to have individual effort to improve our own conditions. You and I can only reduce the cost of our milk, not necessarily raise the price of our milk; therefore, we have got to do the way that lies within our power.

Now, in the first place, we have got to work together, to accomplish those things that require united action. One of the things requiring united action is that education of the public that shows the difference there is in milk. That is real education. It is going to be slow, and it is going to take time; but they have got to learn that difference. When they learn the difference, some people will pay for it; but, after all, they all take just as cheap milk as they can get; and we will all take just as much for it as we can get. I thank you. (Applause).

THE COST OF MILK PRODUCTION AND MAINTENANCE OF HERDS FOR PURCHASE.

By MR. ROBERT EDEKIN, Westtown, Pa.

Mr. President, Ladies and Gentlemen: It gives me pleasure to see so many young faces with us; for it is those especially in my remarks I wish to encourage to be specialists along the lines they choose. It is only through specializing that we can accomplish the greatest results with the least labor and the least expense.

THE FEEDING OF THE DAIRY COW.

A study of the contents of milk—that is one of the first things, I think, we have to study when we begin to learn how to feed. Show that there are solids of 12.7 per cent. protein, 3.1 per cent. carbohydrates, 5.1 per cent. marketable milk, 3.8 per cent. The ratio of 1 to 4.

Now, the subject of ratio has a great deal to do with feeding the

our State bulletin gives for fattening a steer: 26 lbs. of carbohydrates, 3 lbs. of protein, 15.2 lbs. of carbohydrates and .5 lbs. fat. With the ratio of 1 to 5.5, they will produce from 2 to $2\frac{1}{2}$ lbs of gain.

Now, what does the dairy cow do? I don't say that I feed the same as the ration given out by our State Experiment Station. I have worked this out along my own lines for the last nine years; I don't wish to brag any; at the same time I don't want to give it as a wrong idea to any body that the general milk is produced at this price, or that the general public gets the same results from each individual cow. I feed a ration of 22.5 lbs. of dry matter; 2.88 lbs. of protein; 10.82 lbs. carbohydrates; 1.7 lbs. of fat; and 4 lbs. of fiber. That is one of the most vital points in the dairy business—the fiber question. We think we get too much fiber; we discuss the amount of available digestible nutrients for utilization in the milk and meat production; this will produce—if the cow is properly handled, if the man knows his individual cows, if he has made a specialty of his business, watches every thing carefully, individually—it should produce what I have stated, or 26 lbs. of milk per day.

According to my calculations, we have—I will first tell you how I calculate. I add the digestible protein and digestible fat together; I count the protein worth as much as the fat in my feed and multiply that by $2\frac{1}{2}$ (giving it the value of carbohydrates); then I subtract the crude fiber: multiply by $1\frac{1}{2}$ and it gives me what is left for available support and production.

Now, let us make a comparison. In making the maintenance ration which I have given you, we have 3.46 lbs. of digestible nutrients to repair the waste of the body; that much we get no returns for, except to keep the animal. The fattening ration which has been given would contain 15.58 lbs. of digestible nutrients, and would leave for production outside of maintenance, 12.12 lbs.; so we will see, in comparison with the dairy cow, how much more beef would cost us than the dairy products. The ration which I have given for the dairy cow contains 13.82 lbs. of digestible nutrients, and an available amount for production of 10.36 lbs. of milk, which would contain 3.3 lbs. of solids and from 1 to 2 lbs. of flesh, according to the condition of the cow at the time she is fed. If she is thin, she will gain rapidly on that ration as well as production.

My summer ration is made of 2 of cottonseed meal and 3 of hominy meal, that is the grain ration on pasture and fed at the rate of 12 lbs. per cow. A great many think that grain fed to a cow on good pasture is a waste. I have never found it so. I have cut down grain and cut down the products a little beyond what the gain cost, every time. I have increased the crude fiber in my grain ration and have diminished the production and the profits as well. A little over a year ago I tried brewers' grains, using them in the ration with cottonseed meal; fed a little ensilage along on pasture in the fall of the year, thinking probably it would cheapen the cost of production, owing to the fact that we had to pay \$31.00 a ton for hominy meal to take the place of it. The results was, we lost \$3.00 a day for every day that we fed. We lost the use of three cows at the end of that time. We got our cows back to where they were before; but there were three fresh cows put in which had to go to make up the depreciation.

Some will say that those cows would naturally depreciate. That is true. But the weather conditions were practically the same, watched closely. We first lost in the milk, then in the butter-fat—

butter-fat didn't quit dropping when we established the amount of milk that they would produce; and the same way when we returned and fed the same way that we had been feeding—they gained and gained in butter, and likewise they gained in the amount of milk.

Now, in all feed mixing with grain on heavy feeding—on light feeding it would be necessary to use a little more salt; but on heavy feeding, use it at the rate of 12 lbs. per cow—can use 1 per cent. of salt. Have water before the cows at all times: that is one of the most necessary objects. The cow will drink—she will drink at least one-third of her water that she drinks during the entire day, at each feeding. She will drink a large proportion of that before she is done eating. We will hear people say that in heavy feeding "our cows eat it." They won't eat it, if they don't have the water. We can not get them to eat it if they have not got the water. If the cow is thirsty, she won't eat her grain; so the first thing I do where I see a cow has any grain left in her trough, is too look into her water-cup and see if the water supply is properly there; and if that is the case, if the water is there, I remove the feed from the trough; and the consequence is that, nine chances out of ten, the following feeding she will eat up her regular ration.

It is not necessary to cut a cow's feed down permanently because she leaves a feed. None of us would want to go to a restraint and because we left something on our plate this time have them cut us off the next time. We want a clean plate and a clean table; but that is one of the points of feeding—of high feeding—of a dairy cow.

This ration which I have given you contains—or in connection with pasture, assuming the cow eats enough pasture to make up the difference in the dry matter—would contain a ratio of about 1 to 4.75. My winter ration is the amount of grain, composed of 3 of linseed meal, 7 of cottonseed meal, and 9 of hominy meal. This is fed with from 33 to 35—an average of say 33 1-3 lbs. of ensilage and 5 lbs. of fodder—or corn stover, it is called. And while this is a narrow ration, and while it is a small amount of dry matter, it contains all the crude fiber that they give us as necessary in the maintenance of an animal; and I find it very nearly correct as regards the health of an animal.

I think we have as healthy a stable of cows at the present time as we have had at any time in the last five years. We have disposed of as few cows as bolognas during the last year as any time during the last five years. We have lost but two by death; one by bloat on young clover after harvest. The other showed inflammation of the bowels, whether caused by taking in one of these pin tags that are put on her bags, or a nail; I thought it was a nail, but we did not find it; but those were the only two deaths during the last year.

Now, while it has been said that there would likely be some discussion on this paper—it would be torn to pieces, etc.—let us not forget or overlook the educational part of the subject. If we can instill into a few young men to be specialists and to remain on the farm, thereby we have done some good. That is the trouble, or one of the troubles of the present day; the population has diminished in the country and has increased in the city; the producers have diminished and the consumers have increased.

THE COST OF PRODUCING MILK.

Now, as to the cost. I am not giving this as a general cost of milk. It depends on what we are satisfied with, for our products. It depends on what it costs us to raise our products. That is not taken in consideration in my remarks; as I have nothing to do with the production of the crops; it is only the production of milk in the dairy. The grain is all purchased and therefore it is counted at what it costs. The roughage is raised on the farm, and I have given allowances; the hay which I have put in is not a first, nor a second, and hardly a third grade hay. So don't—when I come to the hay question—assume that it nice, white, clean first-class hay; it is not. In an experiment a week ago or a little over, we were feeding ensilage twice a day—fodder that was cut and put in the silo wet, along about harvest—as a noon feed. We fed out what we considered would be 5 lbs. of dry matter, or 5 lbs. of the dry fodder, what would ordinarily come out of the mow. I quit feeding that and gave them hay. All they would eat, which was about 5 lbs. of that hay. And that had to be left for them, before them; they would not clean it up between the time that was fed and milking time in the evening, but they would finally finish it up during the night.

Now, I have put down—I am not thinking on what a building is when it is new, just put up especially for the purpose; because many buildings are up, and if a man was selling us hay and grain off the farm, he would keep the buildings for storage; and, therefore, dividing the cost there a little bit between the cow and the agricultural side of the question. But I have, just for a basis—rent of barn, \$2.50 per head. Investment for cow and dairy equipments, fuel and feed, taking the average of the feed for the entire year, the average amount of feed on hand (I am not buying it from day to day, at all)—the amount of ensilage on hand at last inventory amount to \$450.00 worth. There were thirty odd tons of hay in the barn; and the creamery equipment, which should be in every well equipped dairy; so that you can use up the additional amount of milk that you produce. It is not necessary to dry your cow off because you don't want to produce so much milk. Leave her produce on, keep her up, and work that off in some other way. Therefore, it is an equipped creamery; separator, churn, milk and cream vat, cooler, engine and boiler, with a carload of fuel counted in; and this would average per cow \$88.00 as an investment. The interest on above would be \$5.28, at 6 per cent. The tax on a cow, 25 cents. The depreciation, kept up by selling and purchases, was \$8.00 per cow, or \$800.00 on a hundred-cow dairy. The grain per cow was \$69.39; the pasture I figure at \$1.00. I counted for those heavily grained cows (not cows that are not grained) \$5.33. Hay at \$12.00 a ton of class as described on the farm—\$5.16. Corn stover at \$5.00 a ton, or from 4 to 5 cents a bundle—\$3.20. Ensilage at \$3.00 a ton,—\$12.00. Labor and management, 22 $\frac{1}{2}$ per cent of the gross produce, making \$35.65. Maintenance of creamery equipment and tools necessary around barn, fuel, say \$5.26 per cow; making a total cost of keeping that cow for the year of \$152.02.

These cows yielded per stall and those that have stayed in and are likely to stay in, at the rate of from nine—those that are likely to stay in producing at the rate of from seven to twelve and four-

teen thousand pounds of milk a year; but the average yield per stall for the year was 9,500 lbs., or 4,370 quarts. This would leave us a cost of \$3.48 a hundred, or 3.48 cents a quart.

Now, it would not be practicable, I will say, perhaps, for a beginner to start in and feed such a ration to his cows. It would be well to go on gradually, beginning with the ration that you have every day. Watch your cows closely; you must watch both ends. You must watch the feeding. I mean, you must see whether the cows are right, or not, and in that way you have all the guide that is really necessary, watching the flesh; if they are losing flesh, find out the cause. If they will consume more feed and still won't gain flesh, there is something wrong; and the best way with that cow is to turn her out. Because she won't stand the feeding; and it is the cow that will stand the feeding that we want in the dairy. They are not all constituted alike. And the cow that will stand the feeding, as a rule will increase in flesh along with the milk production; and with that ration you can use a more beefy type of a cow, diminishing the depreciation in value; because if you have a good, large, strong cow, well fattened, we can command a better price for them when we dispose of them. Many cows (not only in a dairy) not only give a production, but go out at an advance.

This last year I have culled out more small cows than any year previous. One of the appraisers that appraised the cows last year, was in the stable the other day; and he remarked that we had a larger grade of cows on hand than we had a year ago. This \$800.00 was taken as an average for the last three years. Three years ago cows were appraised at \$50.00 per head. Two years ago they were appraised at \$55.00 a head. Last year, they were put up to—they were \$50.00 a head for 14 that were a little backward (some purchased shortly prior to inventory times, pretty thin); and the remainder were invoiced at \$60.00 per head. Sixty dollars is what I have based the valuation on.

COW-TESTING ASSOCIATIONS.

By Mr. HELMER RABILD, Washington, D. C.

Mr. Chairman, Ladies and Gentlemen: I have come somewhat unprepared to-day. I have an interest in this discussion, on the cost of producing milk; and it is a vital one to every farmer.

I come here particularly to talk on cow testing associations. That is part of my work in the Dairy Division. You probably have been able to notice that I was not born in this country. I was born in the little county of Denmark, that little two by four country, across the ocean; it has got an area of about one-fifth the State of Pennsylvania, and has 3,000,000 people.

I want to take you back in the history of Denmark for a few moments; and I want you to bear in mind if I say anything about Denmark that might be construed as a boast, it is not; because no one can be more loyal to the country of his adoption than I am to this country; but I believe we will find something in the history of that little dairy country which can produce a lesson. In 1848, 1849 and 1850 Denmark went through a war, which lasted three years; it was declared a victory for the Danish weapons, but it drew heavily upon the resources of the country; it cost a lot of blood and a lot of money. The Danes were just trying to recruit from this war when, in 1864, they were forced into a new war, which only lasted six months; but there was a loss of more money than the previous war; and as a result of this war, Denmark lost the dearest possession it ever had, Schleswig-Holstein. The nation contracted a great national debt—a debt which (to use an expression common in those days), "extended up over the chimney top." You know a debt has to be paid by taxation. Taxation of the resources of the country. Now, what were the resources of Denmark? There was no shipping, no mining, no forests, not anything to speak of; the only resource they had was the soil. The farmers had to foot the bill.

Our fathers previous to this had been engaged in the beef business; they had fed the ration of farmers to cattle and shipped those cattle to England as beef, and made a fair profit; but there came a time when the English farmer thought he might as well raise his own beef; and he asked parliament to restrict the importation of beef, and they did; and they cut the profit out of the beef business. The Danish farmer had lost his last resource, his only resource, the beef business; he stood with a lot of cows in his hands that were good beef producers, but were not worth anything as a dairy cow. The average product of butter per cow in 1884 was 112 lbs. of butter in a year. That was just about the average per cow; Denmark was on the verge of bankruptcy. The rate of interest in Denmark was 3½ or 4 per cent. higher than it was in England at that time. With this large national debt. Taxes went up from two to five dollars an acre a year; and land was very expensive. A number of farmers had to let their farms be sold for taxes; as they could not even raise the taxes. Many of them left their homes and families and came to this country to try and make a new home for themselves; but some remained in Denmark, from attachment of some sort; they would rather starve there than live in plenty anywhere else; and those people went into the dairy business.

That is only twenty-four years ago; the average production per cow in Denmark was 112 lbs. of butter in a year; to-day it is 224 lbs., or in 1908 it was 224 lbs. They have doubled the production per cow, and in twenty-three years; and they have not done it by buying cows. They have not done it by buying dairy cows and

mating fine sires; but they have done it by selection from their own herds, from their own beef stock; in other words, they have converted a beef breed into a dairy breed.

Now, the method they used for doing this was the cow-testing association; and I believe the time has come when the American farmer will have to adopt some method like that. I don't believe that the ordinary American farmer can rely on buying his cows and selling them out when he gets through with them. I know that there are good cows to be bought; they can be bought, of course. There are people that make it a business to breed good dairy animals; and they can be bought from them. Then again, there is a lot of cows—culls—sold off from the herd every year that men can buy them—used to buy them—when they were fresh, and keep them until they were done producing and sell them off again, but the farmer is learning to know more and more about his cows every year and if he has got a good cow, he is not going to sell her; it is only the culls he is going to sell. He is learning more and more about the dairy business every year.

I don't think the ordinary farmer can carry on, buying his dairy cows. He has got to raise them himself. Now, if he does raise them, there are three things he has got to know about each individual, he has got to know the amount of milk they produce in a year, and he has got to know it by the year. It isn't any good to know it by the month; because he has got to feed them by the year. Then he has got to know how much butter-fat there is in that milk; because it is butter-fat that gives milk its market value; and it costs more to produce 5 per cent. milk than 3 per cent. milk, and last, but not least, how much it costs to feed and keep those cows.

There is just as much reason for the dairyman to kick about the high prices of the feed of cows. If there is one point where the American dairyman has been negligent, it is that—that he has not figured the feed, or the cost of the feed. The feed has been so abundant and so plentiful, that he has not had to figure the cost of feed; but the time has come when he must figure it, because the price has gone up year after year. I believe if you want to increase the production of our cows, we have got to follow the same system as the Danish farmer has followed; we have got to select those individuals in our herd that have inherent capacity, or tendency, to produce milk, and produce it at a profit; and I believe we have got too many cows in our herds that have not got that inherent tendency, or that capacity—we have got too many star boarders. A star-boarder is one that never misses a meal and never pays a cent. We have got too many of that kind of cows in our herd. If we had fewer, we would be able to produce milk more economically. The average production per cow in this country here is 142 lbs. of butter per year. I believe it is possible to double that. The Danes have been able to double by selection; and they started with a beef cow; and we have got just as good a herd, we have got a better climate, we have got better feed, we have got better cows to start with, and just as good men; I see no reason why we should not be able to double the production as the Danish farmer has done.

I called three years ago on August King, of Denmark, who had 70 cows. He joined a cow testing association, by the way, a cow testing association is an organization which uses the individual production of each individual. He had 70 cows to begin with; he got an average production of 7,320 lbs. of milk per cow a year. It is a mighty good average. You would not think a man could increase that very much; and yet Mr. August King increased this production in six years to 11,333 lbs. of milk per cow per year. He reduced the cost of 100 lbs. of milk from 66c (which is the feed cost per cow)—66c per hundred to 53c per hundred by increasing the average production. I figure this, on his butter-fat value—156 lbs. of increased butter-fat per cow per year—I figured that Mr. August King increased his income \$2,558.00 a year. For the same labor and the same energy used he fed a little more feed. Now, Mr. August King has been able to do this through the cow testing association, and I will tell you what that is.

A cow testing association is an organization of farmers consisting of 26 farmers that club together for the purpose of making a more economical production, for the purpose of increasing the yearly production per cow, for the purpose of making more money out of dairying. These 26 men form an organization and hire a man—an expert dairyman—to come to their place once a month—twelve times during the year. Now, he comes to my farm in the afternoon. While he is there he weighs the feed of each cow. He figures the cost of that feed and charges it up to the cow at its market price. He weighs the amount of milk each cow gives, and he tests that milk; he does that night and morning twelve times during a year—twelve days during a year. With these figures as a basis he calculates the amount of milk and butter-fat a cow produces in a year, the amount of feed she consumed, and what it costs to keep her; and with those figures as a basis, he makes his selection for breeding purposes.

When he comes to study the individual in his herd, he will find there are three kinds of cows—three broad classes of cows; one class take a certain amount of feed, digests and assimilates it, and from some inborn tendency, or law of her nature, she converts that feed into beef and puts it on her back. She is a beef cow; and you want to make beef of her as soon as possible. Then there is a second class of cow and from some inborn tendency or law of her nature she converts that feed into the milkpail, if that is her tendency; that is a dairy cow, and that is the cow we want to tie to. Then there is a third class of cow that take the same amount of feed, digest and assimilate them, and God only knows what she does with it. She doesn't make it into beef, nor into milk; and that is the cow we want to cull out of our herd. The only trouble in culling her out is to spot her, to find her; because we cannot tell from her looks. We cannot tell by the looks of the cow.

My father was a dairyman. We had a hundred cows, and there were three of us young boys; and he would take us out to the stable on rainy days, when there was no work in the field; he would take us and have us walk behind the cows; and he pointed them out to us. "Now," he says, "there is a good cow." "Why is she good?" We wanted to know. "Don't you see her—curves just so, and her tail reaches down below the hock joint, and that is a sign she is

going to give milk a long while;" and things of that sort we had pointed. My father started the cow testing association, and he found that signs did not count for so much, for you could not tell by the looks of a child how far she will jump; you cannot tell by the looks of a dairy cow whether she will give six thousand or nine thousand pounds of milk in a year. You can tell something of the age of her. You can tell whether the tendency is for to put on fat or flesh; but you cannot tell whether she will give six thousand or eight thousand pounds of milk in a year. We have got to see the Babcock testing scale. Those of our testing associations use the Babcock testing scale. The farmer doesn't have to do his work himself; he hires a man to do it that comes to his place once a month to do it. He has been able, in the cow testing associations we have organized in this country, to get this work done for a dollar a cow in a year. If 26 men club together having 400 or more cows, they can get this work done for a dollar a cow a year and board the man while he is at their place.

Mr. Gerhard Strohman, up in Fremont, Michigan, a member of a cow testing association had an average production of 186 lbs. of butter-fat—4,492 lbs. of milk—per cow. The third year his product had increased to 5,075 lbs. of milk from 4,492. The average per cow of butter-fat had increased from 186 to 215 lbs. He had done that simply by weeding out the poor cows and raising the heifer calves from his good cows. Because the feed cost of 100 lbs. of milk had been reduced from 69c a hundred to 63c a hundred, in spite of the fact that feed prices had increased very much in those three years. Mr. Seal Emmons increased the average production of milk from 4,747 lbs. to 5,812 lbs. in the course of three years as the result of the cow-testing work. Now, I told you that Mr. King had increased from 7,320 lbs. of milk to 11,333 lbs. He did that in this way: He had 70 cows to begin with. He culled them out, except 28. He found those 28 were the good cows that he wanted in his herd. That is, the good cows he wanted, he kept—those 28 cows; kept their heifers; bred them to good sires, and in that way he has increased the production. The next year he had 46 cows—55 cows—61—64; now he has got 71 cows, one more than he started with; and they bring him in 4,116 lbs. milk more apiece in a year.

The National Dairy Division is interested in this idea of increasing the production, because there is so much materially affects the cost of producing 100 lbs. of milk—the cost of producing a pound of butter-fat. We have got now 33 cow-testing associations in this country, out of which one is in the State of Pennsylvania. We hope, in the course of a few years, to be able to increase that number very much. Denmark, in 14 years, has increased the number of

the selection of food-stuff. On the feeding of individual cows. Up in Fremont I went with the cow-tester a few days; I saw him in one place where a man had 35 cows; and over each cow was a little table showing the amount of milk that cow gave, and the amount of feed, of a certain feed mixture, that she received. The man had begun to study the individuality of these cows; and he fed them according to their individuality, and a cow that produced 9 lbs. of milk did not get the same amount of food that the cow that produced 20 lbs. of milk received. But ordinarily the farmer feeds the cows just about alike. If any thing, he feeds them according to their looks, or according to the way he likes them. Not according to their economical uses of the feed, and that is what we have got to study; because we are in the dairy business for the profit there is in it.

Some ten years ago, when I first came to this country, I took charge of a butter factory in a little town of Vicksburg, Michigan. There were two young men in that locality that just got a farm from their father. I outlined the idea of getting good farms, breeding from good heifers, and culling out the unprofitable producer; and one of the young fellows said: "Yes, that is a good idea; I am going to do it." He had the courage of his conviction. But the other says: "I have got 25 cows on my farm; it will cost feed enough to feed 25 cows; I have got to hustle, and I haven't got time to bother with the Babcock tester and weighing the milk and weighing the feed;" and he didn't do it.

Those men ten years ago had an average production of 106 lbs. of butter per cow; and I had the books, and I had the chance to go over them and figure it up. Two years ago I was back in the same little town again, and I called on these two young men. Before I called, I had been to the factory and figured from the butter maker the amount of butter they produced per cow in a year, or the amount they had delivered; and by going out to the farm and finding out how many cows they had kept during a year I found out the average produce. I found that the man who hadn't taken this time to do this work, had about the same average; he had increased something like 5 lbs.; but the man who had taken the time had an average of 220 lbs. of butter per cow in a year. This business didn't strike me so very forcibly at first, but when I got figuring it out in dollars and cents, it did. The man who didn't have this time to do the work, got an average profit of \$4.00 per cow a year; but the man who did take the time got an average profit of \$20.00 per cow a year.

You will remember that the feed prices out in Michigan four years ago were very low; you cannot compare them with your feed prices at the present time here in Pennsylvania. Now, it simply means that the man who didn't take this time for his work, he has got time or must take time to work four years to accomplish what the other accomplishes in one year. I maintain that life is too short to spend four years to accomplish what you might accomplish in one year. The cow-testing association will enable us, by the study of the individuality of these cows, to increase the production per cow and that way reduce the cost of production. I believe that is one of the most important factors in this whole question of cost of production—in our individuality of the cow, next to the individuality of the man.

CREAMERY CONSTRUCTION.

By MR. M. P. DARLINGTON, *Pomeroy, Pa.*

The only knowledge that I had of this occasion was that I was on the program; consequently, I have not prepared any thing at all for the occasion. I made a few notes here that I will try and make a short talk on; but I supposed the reason the committee selected me for this topic is, the fact that we have just finished building a new creamery in Lancaster county at the White Horse; but I want to tell you there is where they made a mistake; because we just learn now that we don't know very much about creamery construction. It is the man who doesn't do things that can tell you how to do it. We all know the fellow that pitches hay in January and cuts ice in July: he is the proper one to tell you all about it; but, however, we will try to make a talk on the subject.

STABILITY.

Now, I think the first and foremost consideration in building a creamery is stability. We want something that is substantial and fireproof. There is entirely too much risk about the business of an established creamery in the possibility of someone's carelessness destroying the plant and throwing the business all to the four winds temporarily; and consequently we must look for something that is substantial; a stone building, if stone can be had not too expensive; or brick building; or a cement block—any of the three makes a nice appearing and a good, substantial building; and then, for a roof, we need something that is fireproof. Slate, of course, is very good, but heavy; if you have a pretty large building, without a proper support, it makes it objectionable. We use the brown roofing that is put out by the John Mandeville Company; which is a very strong fabric, coated with asbestos. We believe that to be good and fireproof, and has the advantage of being much cooler

CONVENIENCE.

Now, the next important point is the matter of convenience. I think there is a very decided objection to some of the older methods of construction by which the milk was taken in on the high side of the building and allowed to run by gravity to the different rooms down to the machine; and when we consider the immense amount of labor it makes for the butter-maker running up and down steps, it certainly is worth considering—the simple matter of having one or two sanitary pumps and having all our floor on the same level is a great deal more convenient and less laborious for the butter-maker, and also puts him in a position he can get more quickly to his machinery if anything goes wrong when he is receiving milk from his patrons; and that is, of course, quite an advantage.

DIMENSIONS.

Now, for the dimensions of the building, the approximate dimensions. A building about 30 x 70, a long narrow building, comparatively, I think has many advantages. In the first place, it gives you more light in your main machine room. If you can get the correct location, I would suggest making one end of the building to face the north, and have a receiving projection for the teams to drive under at the receiving point, about the middle of the building; just opposite to that, on the other side of the building, have a back porch for loading and unloading heavy material, such as salt and such matters; and it also makes a much better appearance to the building; you can run a gable through the building from one side to the other, that is, on either side; and it destroys that low, squatly narrow effect of a long narrow building. Then you have the advantage of the light in the machine room. In the northern end of the building we would suggest constructing the machine room, as being naturally best adapted, and opening from the refrigerator into a vestibule, which we can use for printing butter in warm weather. This printing room to have a creamery separator in there, if you prefer, you have got a sufficiency of cold air from the refrigerator; every time the door opens, it will roll out—you get sufficient cold air draft on the hottest days in summer to keep that room at a suitable temperature for handling butter. Then directly opening from that room I would make the churn room. Of course, this churn room would be used the main part of the year as a printing room. We only use this inside printing room in very hot weather in summer. The churn room so to speak would be a block out of the main machine room; and that leaves all the rest for the center part of the building for the main machine room, with lots of light on either side; the milk received on one side, and the separating machinery and pasteurizers, etc., about the middle of the room, with the drain situated close; and over in the other corner we have the refrigerating machine, which I think is necessary in a modern creamery; we can hardly take the risk of getting natural ice, the kind of winters that we have had—until this one, of course, this is an exception. If we have our refrigerating machinery, we know just where we stand, we have the desired temperature at all times. Much lower temperature than we can get by natural ice, with a refrigerator.

Then, in the other end of the building (which would be in the south end), we would arrange to have the boiler room. We can have the steam gauge and clock arranged inside of the partition wall, so that the butter-maker, as he is receiving his milk, has everything directly under his touch. He can see exactly what his butter is doing, what all of his machinery is doing—the separator, pasteurizer and pumps and cooler directly under his eye and within a hand's reach if something needs adjusting quickly.

MACHINERY.

A word as to the machinery. Of course, that doesn't come exactly under construction; but it is a very material consideration. I think the best machinery is none too good. There is a great deal of machinery, of course, comes out that is theoretical and not practical; but in a general way, if we select the best substantial modern machines that have been tested out in the line of engines, pumps and pasteurizers, and that like, it is safe that we are on the right track. Now, the work of the best butter-maker, and the most careful work in the care of the milk, can all be spoiled by a little bit of unsanitary piping—some place where the milk or cream runs and cannot be thoroughly cleansed from day to day. There are liable to be a species of bacteria that may make a very unsatisfactory flavor in our butter, and in that way spoil all the good work that the butter-maker might be doing otherwise; so, as I said, a few dollars spent in the shape of sanitary piping and sanitary fitting is certainly worth the while, and is an expenditure that would be repaid in the quality and uniformity of the product. We prefer to pasteurize the cream direct from the separator. Of course, there is a difference of opinion on the subject of pasteurizing the whole milk with the cream, or not pasteurizing at all; but we find we get more uniformity and better results with pasteurizing.

WHEY TANK.

Now, one point I want to mention is an eye-sore, or rather a nose-sore about a great many creameries—the whey tank, where the refuse is left from making cheese or curd, as the case may be. I think it would be very important to have that a little distance from the creamery and entirely out of the way from it, and by all means have a cement floor underneath, so that the whey and slop spilled around does not come in contact with the earth and make a bad odor about the creamery. We all know that the patrons that come to a creamery foul-smelling and bad and unsightly around in any way—it doesn't afford very much encouragement to take extra good care of his milk; and the natural tendency is to make him a little bit more careless in his end of the work. I think in a general way that neatness and cleanliness are two of the points that we want to strive for, above all other work you might say; because it means so much. You take the man who has been accustomed, who is inclined to be careful and do good work; if he is fighting against odds all the time with unsanitary surroundings and unsightly clutter and rubbish lying around, that has a certain effect on that man which he may not recognize, but nevertheless it has; we all know that we all do better work when we are imbued with the spirit of the

occasion; and in that way I think we can help the butter-maker a great deal by keeping everything about neat and looking well, and not have offensive odors; and then there is no excuse for the careless patron, because most of the bad butter—we who have studied the subject at all know that most of the bad butter is the fault of carelessness on the part of the patron taking care of the milk. I think it is a very good motto, in the creamery business as in any other, that work that is worth doing at all is worth doing well; and it is a good idea for the butter-maker to have that "100" mark foremost in his mind.

**ABSTRACT OF PAPERS READ AT ANNUAL MEETING
OF THE PENNSYLVANIA LIVESTOCK BREEDERS' AS-
SOCIATION, HELD AT PHILADELPHIA, PA., FEBRU-
ARY 2, 3 AND 4, 1910.**

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DEMONSTRATION IN BEEF CATTLE.

By PROF. W. A. COCHEL, *State College, Pa.*

We have met here this morning to have a demonstration in beef cattle. As we all know, the question of beef is of very vital importance at the present time, and in order that we may be better prepared to discuss market demands, we have brought in an animal with which to study and bring out the points of a good beef animal. For this purpose we have secured an ordinary market steer—one that would probably classify as a good beef steer on the market.

The cattle feeder, who feeds for the market, wants a steer that he can feed for three or four months, and then have him ready for the market. In selecting his cattle, he should pay a great deal of

attention to the head. He wants a short, broad head, broad between the eyes, with a short, full neck—a blocky, low-down animal, with a deep body, indicating good digestive organs—one that will mature quickly. In selecting feeders, it is important to select one of quiet disposition, so that he will not waste his energy in restlessness, but apply it to the digestion of his food. However, when it comes to 'the butchers', the head is of very little importance. He gets very little for it, and it is not important with him to pay much attention to the head of the animal.

The neck comes next, and the shorter and thicker it is, the better. The meat that comes from the neck is very cheap beef. That is where we get our chuck steaks and boiling pieces, and it sells at a lower price than other parts of the animal. We want the neck thick because we want thick muscle which indicates a thick covering over the entire body. Then, we want the shoulder and neck to blend. In a well rounded animal, you can really not tell where the neck ends and the shoulder begins. Then we want him well covered all over his shoulders. This animal is not very well covered over his shoulders. He is not well finished.

We started in with the head and neck of the animal, and I want to call attention right here to one difference between the dairy and beef type. The beef cow has a short, thick neck, and the dairy cow has a long slim neck. The animal with a long slim neck is more inclined to pay special attention to the production of milk than the one with the short, thick neck. When standing behind the finished beef animal, the ribs should be so well sprung as to make the back almost level. In other words, we want to be able to draw a straight line from the shoulder to the rump, having it touch all along. In the dairy cow, we want a wedge-shape—slim and somewhat narrow at the neck, increasing in width towards the rump. In the beef animal we want a straight back, because it usually indicates heaviness and thickness of the muscle.

The highest priced cut in the forequarters is the rib, where we get the prime cuts of rib, and a little farther back is where we get the sirloin and porterhouse steak. It is important that we develop just as much as possible of rib, loin and rump, for along here the high priced cuts are located. If we run a line from the point of the shoulder parallel with the ground across the body, we find that the high priced meat is above that line, while the low priced cuts, like the brisket, are under it. In selecting a beef animal, we want to get just as much of him above the medium line and just as little below as possible. He should be deep in his forequarters, as there lies his heart and his lungs and his vital organs, and he needs all these well developed to enable him to breathe well and to digest his food thoroughly. Then we want him to be well developed in depth of hind flank, so as to give him capacity.

In a beef animal, we want an animal that will develop easily and mature quickly. In order to do this, he must be able to consume and digest a large amount of food. When we look at him from the side, we want him to be built close to the ground. Too many are upstanding and shallow, hence are not able to consume a large amount of food, consequently it does not pay to produce them. An animal

that is built close to the ground will finish up easier, and mature quicker on the same amount of food. If you take these upstanding animals, you will find that they require two, three or four years to finish. As land advances, the question of producing beef animals in this section becomes an important one, and the point of early maturity is one that we cannot afford to overlook. It means dollars to the men who produce beef cattle. Then we go back here a little further, and we want the hips to be smooth. We buy feeders for possibly four and a half or five cents a pound and it costs from ten to twelve cents for each pound of gain. We find that the less prominence there is in the hips and in the shoulders, the quicker he will finish. Then, we want him to carry his width straight out to the rump, so as to get a larger amount of the high priced meat. In other words, we want a beef animal to carry his width from one end to the other. Then, there is another point in the beef animal that we must consider, and that is his hind flank. We want a deep hind flank, so as to get a heavier proportion of the round, which is one of the valuable cuts of beef.

I have said nothing yet as to quality, which, aside from form, is next most important. We want quality—good handling quality—a skin that is a mellow, a loose hide. We find that the stomach and internal organs are simply a continuation of the outer skin, and if we have a good, mellow hide on the animal, digestion is good. Then there is quality of bone. We want a fine-boned animal for a meat steer, with a good covering of muscle and fat. When we find a big-boned animal, we find at the same time a big, heavy animal, that will take a long time to finish. It is possible, however, to carry selection for fine bone to excess. You want an animal whose bones are in proportion to his size, as fine bone as you can get in proportion to large development of body. The development of bone should be sufficient to hold up the body. Anything more than that is superfluous. Then comes the quality of his flesh. That should be fine grained and finely marbled. We find that meat from an animal of quality is always of finer texture than the meat from the coarse, heavy animal.

After we have selected our animal of the type and quality most desirable for the production of beef, we will find that he will consume a larger amount of rough food than the dairy cow, and of concentrated feed, also. The first thing to feed for, is for maintenance. Suppose that a thousand pound steer eats approximately twenty pounds a day; fifteen of this goes for maintenance, and the other five into the making of beef. On the other hand, if the animal has the ability to consume twenty-five pounds, he will be just so much quicker in finishing, using fifteen for maintenance and ten for production. Therefore, in selecting our animals, it is advisable that we procure them with large feeding capacity. Now, that is not so necessary when it comes to marketing. An animal that is well developed in the paunch is not so desirable, because there is too much waste. In the feeding of this steer, and in the selection of a fat steer, there are three places in which you can judge whether or not he is fat. When the steer is finished, the outward evidences are a fulness in the throat, due to a deposit of fat at the base of the tongue, a thickness in the hind flank and a fullness in the cod due to a deposit of fat in these regions. This animal is pretty well filled out for a market

animal, but the round is deficient in depth and width, as the feeding continues his loins become thicker, and the width across the rump increased. You have noticed that when you first put a steer to pasture that his four legs seem to follow the same path, but as he fattens you will notice a difference, as a thoroughly finished steer makes two paths. His fore legs and his hind legs are far enough apart to do that. Another advantage in an animal of this kind as compared with the dairy-bred steer is the thickness of meat of the valuable cuts. As he becomes thoroughly ripened and fattened, this fat is distributed through the muscles, increasing their bulk. A fat steer will sell in the Chicago market for eight to ten cents; one that is not fat but in "feeder" condition will bring four to five cents. A steer like this will bring about six cents. As an animal develops a greater proportion of the higher priced cuts of meat, it becomes more valuable.

In fattening steers for market, a man must be guided largely by what he produces on his farm. The man who raises a large amount of corn and roughage has two outlets for his products: Either he can market them in the original form, or he can feed beef cattle, obtaining a market value for his crops, at the same time returning the fertility to the soil in the shape of the manure, thus making a double profit on his land. By adopting the first method, a man is much more likely to take the fertility out of the soil, as has been done in so many sections. No better method of restoring this fertility can be found than by feeding roughage crops to our cattle, and in that way get more out of the soil and out of the market than by selling the crops in their original form. The question of feeding is one that we could talk on for a couple of hours, but it is one that each man must consider for himself. We must make the most of our grass and of our pasture in feeding cattle in Pennsylvania, for which this State is well adapted. It used to be that it paid best to go West and ship the cattle from there, but as our land decreases in fertility and cattle values increase, it becomes more profitable for us to raise our own cattle. From a Pennsylvania standpoint, we want to select and handle cattle that will grow fat on grass, and with our grass crops, and our forage crops to feed, will take but little corn to fatten. That is only possible from the use of the well bred animals which mature quicker and on less food than the scrub animal.

The question of winter feeding must also be considered. If a man has a large amount of corn, and a small amount of pasture, he can afford to produce the so-called "baby-beef," but if he has a small amount of corn, and a large amount of pasture, it will pay him better to take a year or two for growth before finishing for the market, and to use some nitrogen supplements in connection with farm crops, where he does not have alfalfa. One of the best feeds for beef cattle is corn silage. The work of the Indian Experiment Station the past four years shows that the cattle fed on silage mature much quicker and easier than those fed on anything else, and command a better price. Silage will be one of our best feeds for fattening beef cattle in Pennsylvania, as well as one of the most valuable feeds for the dairy cow.

Of course, type will have some influence on the profitable finish for market. If you have a coarse, rough animal, that nothing will ever develop into a first-class animal, you had better market him as

a butcher steer. If you have a high grade beef animal, it will pay better to feed two or three months longer. As we increase the quality and improve the type of our animals, we can better afford to make them fat and produce a high quality of meat than to handle the ordinary grades of cattle.

I have said nothing about dairy cattle, because we will have a dairy cattle demonstration here, and I will leave that for the dairy-man; but I will say that the dairy cow stands in a class by herself as a producer of human food, and for economical consumption of forage. There are conditions, however, where it is unprofitable to produce a dairy cow. The dairy cow is broader across the hips and hind portion, and is wedgeshaped, while the beef animal carries its width straight through. In looking at the beef steer from all sides, the more nearly he approaches straight lines, the more nearly he approaches the highest type of beef animal. That is the difference between the two types of animals. The main reason that we want this thickness in the beef animal is that it gives us the thickness of meat.

These two animals are in nearly the same condition, and you will notice the difference between them. We want beef cattle to have a heavy flank; this is one of the indications of the good beef animal. Now, this animal is not an extreme beef type; it has not been fed long enough to bring out the points of a good beef steer. He has good quality and a good covering of flesh, but no great amount of fat. He has a decided droop in his back, which detracts from his value as a beef animal. The back of a beef animal should be perfectly straight. It indicates a thickness of muscle. Then, he is very deficient in the round. That might be developed, but not brought up to an ideal condition. From the butchers' standpoint, he will not dress out well enough in the choice sections. He has entirely too much weight in front for a steer of beef type; the high priced cuts are in the back. He has, however, a good coat of hair, and a good skin on him. Of course, he has not fat enough to show to the best advantage, but on the whole he is a good steer, not very well finished.

MR. BAYARD: Tell us what he is billed at.

PROF. COCHEL: This steer weighed 960 pounds at Pittsburg day before yesterday. He sold for six cents a pound. He is not in the best condition, due to his shipment from Pittsburg, and spending several days in the car.

A Member: You say he is not very well finished; if he had been fed better, so as to weigh say, seventy-five pounds more, would that put him in a better condition?

PROF. COCHEL: Seventy-five pounds would not finish him. In order to sell as prime, he would have to have three hundred pounds more.

MR. BAYARD: It wouldn't pay to put it on, though. He is in about the right condition for the Pennsylvania market.

A Member: How much would three hundred pounds make to the butcher when he comes to sell him?

PROF. COCHEL: About two hundred pounds.

A Member: Would it not be nearly all fat?

PROF. COCHEL: Yes, it would be largely fat some of which would be distributed in the lean.

A Member: Would not the butcher have to trim off the fat, so it would not be very profitable?

PROF. COCHEL: That is a question of putting on fat; if the fat were distributed within the lean it would add to the quality and make the meat more tender. Then, of course, there would be some waste. It would add more to his internal organs. If he should add three hundred pounds more it would increase the outside layer of fat, to some extent, which, in a local market, would not be so desirable, but in a fancy steer the outside layer of fat is required because it adds to the flavor of the meat to cook it in its own fat. The whole question of finishing cattle is this: When you are finishing a two-year-old steer, you should increase his value per hundred every day; at the present price of feed, the very best possible system of feeding a steer would require a monthly increase of thirty-five to forty cents per hundred in selling value in order to insure a profit.

A Member: How does the Holstein rank as a beef animal?

PROF. COCHEL: They are dairy cattle, and among the very best dairy cattle, but if developed for beef, they lose some of their very best qualities. They are not beef cattle.

A Member: But they are generally marketed for beef.

PROF. COCHEL: Of course, they always sell for cheap beef, but they do not develop the very best meat. When you attempt to produce beef from a dairy animal, you make a mistake. The time to make beef out of them is as veal. The Holstein calf has as much value as veal as the Angus or the Shorthorn.

A Member: What kind of a steer would be best for the farmer to buy?

PROF. COCHEL: It depends very much upon what the farmer has to feed him. If he has a large amount of roughage and a small amount of corn, the thinner he gets them in proportion to the price he pays, the more profitable. If he has a large amount of corn, he wants to buy them as fat as possible.

A Member: You spoke of producing "baby beef." What breed would you recommend the Pennsylvania farmer to use?

PROF. COCHEL: The Hereford, the Angus, or the Shorthorn are the best. In the production of "baby beef," the calf wants to have the milk of the cow, and learn to eat corn while suckling. If it is weaned at six months of age it will take from eight to twelve months of heavy feeding to make prime baby beef.

A Member: How is the marbling of meat produced?

PROF. COCHEL: It is part of the breeding of the animal. In the first place, you want an animal of the beef breeds so that it will distribute the fat among the lean, and in the second place, it

comes from feeding. If fed strictly on corn and timothy hay, the animal will not develop as much marbling or as quickly as if fed on the more nitrogeneous feeds, like alfalfa hay or bran—but bran is too expensive to feed beef.

A Member: Do you not get better results from the feed given a calf or a one-year-old, than from an animal three or four years old?

PROF. COCHEL: Undoubtedly we do, but they do not increase quite as rapidly in value per hundred while we are feeding them. When we are feeding the younger animals we must feed a larger proportion of corn and less roughage than with the mature animals, but if you look at it from the point of the amount of digestible food required to produce a pound of beef, the younger the animal, the better. In the work I have been doing the past four years, we have been buying calves yearlings and two-year-olds and feeding them for market for experimental purposes. We find that our two-year-olds will be ready for market after five to six months of full breeding. Our yearlings require a month or six weeks longer, while the calves require about three months longer to get the same degree of finish.

A Member: What would be the rate of progress?

PROF. COCHEL: The two-year-olds may be more expensive to begin with, but they make a more rapid gain, so it makes them less expensive in the end.

A Member: How long would it be possible to have the calves run around with the herds of cows and still insure a calf every year?

PROF. COCHEL: I was brought up in Missouri, where we are in the habit of letting our calves run with the cows all the time. We usually wean our calves at six months, and expect to get a calf every year. We allow them to run in the blue grass pasture in the summer. If they drop their calves about pasture time, we usually turn them into the field and then carry the cows over winter on roughage. We give all the advantage to the calves, and by weaning time expect them to weigh 500 pounds.

A Member: Do you let the cow go dry during winter?

PROF. COCHEL: Yes.

SHEEP DEMONSTRATION.

By H. NOEL GIBSON, Millbrook, N. Y.

Sheep are apt to develop parasites where they run for a great length of time on the same land. You can run them in one place for one or two years, but after that time they are sure to become infested. However, there is a cure for it. If people gave one-half as much time and attention to their sheep as they do to their dairy animals, they would not have half as much trouble. It is just as

easy, and a good deal easier. There is no getting up at four o'clock in the morning, and no washing or sterilizing, or anything of that kind. All you want is a little horse-sense, and you will get along. Now, I don't mean to say anything against any branch of farming; but there is no reason why the farmer should not do a little in the sheep line in connection with his other lines. Any farmer who has fifty to a hundred acres of land should have fifteen or twenty ewes. The sheep will always deposit their manure on the highest ground and help to fertilize the land where it is most needed, as they never lie on the low land.

The Middle West is producing lambs at present, and bringing them probably two thousand miles to our markets. These lambs should be raised right here at home; there is no reason why it should not be done very easily and profitably. In fact, it is our duty to do so. If the West had any competition in the meat production, there would not be this case of boycott that there is now going on. Another point to remember, is that if the West decided to boycott the East, there would not be enough meat left in the East to carry any one of our cities for a week.

We have two lambs here. They are both Shropshires and from the same farm. Now, when I go to market and look over the different lots of lambs, I want to buy a lamb that is close to the ground, with a good leg of mutton, and a good spring of rib.

Of these two lambs, the larger one on my left is 350 days old, and the one on my right is 308 days old. The difference in their weight is twelve pounds. They were fed practically on the same feed. The same rule holds good in sheep as it does in beef animals—you must have a good, short leg, a good body and a good digestion. This lamb, from the killer's point of view, is a good lamb, very well developed in the higher priced cuts of meat—the cuts that command the most money. From the farmer's point of view, a little more conformation would be what we want.

Now, I might say a few words in connection with starting the flock. In the first place, you must take your market into consideration. Right here you have a very good market for hothouse lambs, but the man who has no facilities to market them should not undertake to raise them. He should raise them to sell at from six to eight months old. For this purpose I would recommend some of the Down breeds—also the Dorset would afford an excellent means for the farmer to continue his flock. In starting a flock, it is well to get ewes that are not too old. You cannot do better than go to the West, and get some of the western ewes. When the lambs are six to eight months old, they are ready to go to market at sixty to eighty pounds. You take some of our heavy-boned sheep of the West, and put them on our light soils, and they will not do so well. Any place west of the Rockies they will do very well.

Another point to take into consideration in starting a flock is the output of wool. While some of the best mutton sheep run a little light in wool, that can easily be overcome. This little lamb has one of the best fleeces I ever saw on a Shropshire sheep. Now, I have told you all I know, and perhaps more than I know. Have you any questions? Perhaps I can answer them.

DR. HUNT: What is the value of these sheep if put on the market to-day?

MR. GIBSON: There is very little difference in their market value. The difference would be in the profit they would make. I would take the one with the short legs and heavy body first.

A Member: Tell us how to care for sheep.

MR. GIBSON: I will start with a flock of ewes. Feed them through the season a little grain and a little hay. You will have to use your judgment. A little oats and bran will be very good, if you have them. Then we will suppose we approach within a month of lambing time. Some of your ewes may be strong and some may be weak. Select your weak ones and feed them a little better until they receive a pound a day. Keep your ewes in pretty good condition, so they will have a supply of milk for the lambs when they are dropped. Many a lamb is lost because the ewe has not enough milk to feed it with. Then when lambs come, take your ewes and confine them in a pen for two or three days, and feed them some milk producing food, such as bran, hay, and some of the oil meals. Or, in the Spring, turn them into a piece of rye. You will find it an excellent thing for them, and they like it. Leave them there for a month or six weeks, and then turn them into a field of clover. Your lambs will probably develop stomach worms there, but that can be overcome. Feed them on rape, and then you will not need to feed them any corn until you are going to market them. They will gain on rape as on no other green feed for ninety days, making a gain of forty-five pounds, and in this way you can avoid the stomach worm; or, there are a number of preparations on the market, which I have every reason to believe will do what is claimed for them.

A Member: What sort of ewes would you buy?

MR. GIBSON: Well, in buying ewes, I would want the legs as close to the ground as I could get them planted, and with a good length of body and good spring of ribs.

A Member: What breed of lambs is it best to raise?

MR. GIBSON: That depends for what purpose they are intended. If for hot house lambs, the Dorset, probably, because it can be bred at any season of the year.

HOW CAN WE IMPROVE OUR CORN?

By PROF. F. D. GARDNER, *State College, Pa.*

Mr. Chairman and Gentlemen: I am very glad that this is to be a discussion, and that you are to take part in it. I am not here to do all the talking; simply to lead the discussion. I am always willing to advocate anything that will improve our corn, and give the farmer an increased yield and a larger financial return.

There is a great deal that can be done, it is true, by building up the soil, by the better preparation of the seed-bed and by the rational use of manure and fertilizer, but I want to speak to-day more especially of the improvement of the corn itself by selection and breeding. All realize the value and importance of good breeding in live-stock, and I want to say to you that the same principles apply in the breeding of both animals and plants. It is just as important to have well-bred and well-selected seed corn as it is to have well-bred and well-selected animals.

In the selection and breeding of corn, it is well to use only the varieties and strains that yield well. In the selection of seed corn, we should always look for the ears growing on good stalks and accept only those that have their desirable characteristics well marked. For instance, you will note that this Champion ear is not only a large ear, but is it different in regard to the character of kernal from the ten ears exhibited from the same lot of corn. I will venture to pronounce this ear a sport, and the man who exhibited it discovered something worth while. I hope that the man who brought it will have it tested and compare its progeny with that of other ears, in order that he may report results another year.

After you have discovered something that promises to be of value, the first thing to do is to find out if it really has value. When in search of an animal as a sire, there are three things to take into consideration: First, the pedigree of the animal; second, his appearance; and third, if possible, his performance. The same three things apply to corn. You can tell whether it is fine looking or not but you cannot tell by appearance what the performance of the seed will be. How are you going to find out? Simply by planting by the ear row method —each ear planted in a row by itself, so that you can ascertain if it will give a big yield of a good quality of corn. In a corn show you cannot know that; all you can know is that it looks well. If you have twenty or thirty ears of fine seed corn, plant each ear in a row by itself and see whether certain rows give you a better production than others. Then, in harvesting, you should harvest each row by itself, keep the corn separate and select your seed from a few of the rows that promise best.

I was very much interested in a little slip of paper which you saw in the corn exhibit, explaining ten exhibits of three ears each. Those ears represent the product from each of ten ears exhibited last year. Each ear was planted in a row by itself and the yield of corn from each ranged all the way from five and a half bushels for the lowest to eight bushels for the highest. This variation was undoubtedly due to the inherent power of those ears to produce, and it is up to the grower to select seed for his next year's crop from the rows that produced best.

The ear row method of planting corn gives the best chance for rapid improvement. It enables the grower to not only increase the inherent yielding power of the corn but enables him to change other characteristics such as height of stalk, position of ears or time of maturity. Corn that is too late for a certain locality may be made to mature earlier by selecting seed from the early maturing stalks. Out in Illinois, by using the ear row method of breeding corn in experiments extending over ten or twelve years, they have changed the composition of the corn, increasing the protein and fat in one strain and decreasing it in another.

A Member: Can you increase the protein very much without decreasing the yield?

PROF. GARDNER: Yes; it is possible to do so, but in this case there was a small decrease in yield. That is something you must look out for. Breeding for the greatest possible development of one character often results in a deterioration of others.

A Member: What is the difference between the highest and lowest protein?

PROF. GARDNER: Nearly double, and becoming greater each year.

I don't want to make much of a talk. I believe we can get more out of it by having sort of an experience meeting.

A Member: How far apart are the experimental rows?

PROF. GARDNER: Just as far apart as the others.

A Member: Has the pollen mixed?

PROF. GARDNER: Corn is naturally a cross pollinated plant. A man starting with one ear does so with a disadvantage, because the resulting stalks are all from one mother plant, they are closely related and the result is injurious. When ears are planted in separate rows it is desirable to detassel alternating rows and select seed ears only from the detasseled rows. All kernels on such ears are the result of cross pollination.

A Member: In planting seed corn, is it not a good idea to get an ear as near to the ground as possible?

PROF. GARDNER: I advocate having nodes as close together as possible. At each node a leaf is produced and the leaves are to the plant what the boiler is to the steam engine. They are the lungs of the plant, and the more leaf surface you have, the greater the power of the plant to manufacture corn. Furthermore, the leaves are the most palatable and nutritious part of the stalk when used as forage.

A Member: Is it desirable, as a rule, to have suckers in the stalks?

PROF. GARDNER: Not as a rule.

A Member: Does the position of the ear on the stalk have anything to do with the length of time it takes it to ripen?

PROF. GARDNER: Not especially. If the ear is high there is generally more stalk and the chances are that it will ripen a little later than the low ear, although this does not necessarily follow.

A Member: To what extent does detasseling increase the production per acre, and is it of greater advantage to detassel every other row than every other hill?

PROF. GARDNER: Quite a number of experiments have been tried along this line. In some of them there was a slight increase in yield, while in others there was a little reduction. On the average there was no material difference the first year. Theoretically, the progeny of the detasseled rows would be the more productive.

A Member: Would it be to advantage to detassel every other hill or every other row?

PROF. GARDNER: So far as the immediate effect is concerned I do not know that it would make any material difference. It would be more convenient to detassel every other row. I might say that in our breeding plat each row is planted from a separate ear.

A Member: Is there any advantage in detasseling every hill in a row, or would it be better to detassel every other hill, in the preparation for seed corn?

PROF. GARDNER: It would be better to detassel the whole row; because if you detassel but one hill and leave the one next to it, the detasseled hill will receive pollen from the next hill in the same row. All plants in any row are closely related, being from the same mother plant, and it is to avoid close pollination that we resort to detasseling alternating rows.

A Member: Is it better to pull the tassel out, or to cut it out?

PROF. GARDNER: It can be pulled with less injury, if done at the right time, than if it is cut out. In cutting you will be apt to injure the leaves and make a worse wound than if you pulled it out at the proper time.

A Member: You could not detassel six rows and then leave six rows?

PROF. GARDNER: I have not seen it tried. If satisfactory pollination would result, it would facilitate harvesting when the whole plant is harvested. I have seen good results where they detasseled two rows and left two, and I also know of an instance where they detasseled two rows and left one.

A Member: If we could detassel four that would be sufficient.

PROF. GARDNER: Yes, that would facilitate the cutting and shocking of the corn.

A Member: How do you make the seed test for the yield of the corn?

PROF. GARDNER: Well, we usually do it when the corn is standing. This year at State College we cut and shocked each row by itself, but that would be somewhat impracticable for the farmer.

A Member: You just worked it out on small plots?

PROF. GARDNER: No; it was in a small field with rows three or four hundred feet long.

A Member: You just worked as much as you wanted to use for seed in that way?

PROF. GARDNER: Yes.

A Member: If two distinct varieties are planted side by side, say a long-grained variety in one row, and a short-grained variety in the other, which would predominate in the crossing?

PROF. GARDNER: I don't think there would be any marked difference the first year.

A Member: In other words, if you detasseled the long-grained variety, how much influence would the short-grained variety have on it the following year, if you used it for seed?

PROF. GARDNER: Probably about one-half of it would be medium, one-quarter short-grained, and one-quarter long-grained.

A Member: What would be your procedure, then, if your corn showed a tendency toward a short grain, thus producing a deficiency in kernel?

PROF. GARDNER: I would increase the depth of kernels by selecting and breeding or secure seed of a new strain that would meet my ideals in this particular. It would not be wise to attempt the desired improvement by crossing two varieties that differ greatly.

A Member: What would be the result of a violent mating?

PROF. GARDNER: It would be rather disappointing. You would secure a rather small percentage of desirable types and it would take several years of selection to fix the character which you might desire.

A Member: What could you do the second year to make it come true?

PROF. GARDNER: You have a cross between a very shallow-grained variety and a very deep one. The result would be a limited number of deep grained desirable ears. In order to fix the new type you will have to select and plant by the ear row method, selecting the seed ears from the rows, the product of which most nearly conforms to the desired type. In this way it will take several years to accomplish the desired results.

A Member: You would have to detassel the short variety, or the long variety?

PROF. GARDNER: You would now have a new variety which it would take several years to perfect.

A Member: In selecting these, you would put two rows side by side and select them the same way?

PROF. GARDNER: No; I would plant by the ear row method, isolating the seed patch as far as possible, so as to avoid outside pollination. I would then select my seed from those rows that produce kernels desirable in depth. I would continue the selection and breeding in this manner until the desired result could be secured.

A Member: In detasseling does it have any bearing on the size and quality of the fodder, as well as on the ear?

PROF. GARDNER: Not that I know of.

A Member: For instance, the fodder of one variety is very long and that of another is very short. Do you know whether the male or female predominates in that case?

PROF. GARDNER: Neither predominates so far as we know.

A Member: Suppose a man has alongside of good corn one row of another variety from which he wishes to select seed, is it best to detassel the row that has been planted alone or let it fertilize the other corn?

PROF. GARDNER: The first is correct, if you have only this one row to select from. The effect from the pollination of this one row on the field would be very slight because it is only one row in many.

A Member: Which corn would predominate?

PROF. GARDNER: The immediate product from the individual row of corn would not differ materially from the seed but the progeny of this would be intermediate between the two varieties.

A Member: Which has the greatest feed value and which will produce the greatest number of bushels—the white or the yellow corn?

PROF. GARDNER: We have made a great many experiments on that, and there is no material difference. In the North we grow the yellow corn more extensively and on an average it will outyield the white. In the South the white will outyield the yellow. When we take the average of the two sections, there is practically no difference in the yield. Chemical analyses of many samples show the average composition of the white and yellow to be identical.

A Member: Professor, do you mean to say that you cannot select ten ears here that would be representative of the production of that corn?

PROF. GARDNER: Yes; you cannot tell by looking at it whether it will yield thirty or fifty bushels to the acre.

A Member: But would it not be fair to assume that corn that will produce deep grains on the cob, will produce deep grains in the field?

PROF. GARDNER: Oh, yes.

A Member: But the deep grains will produce a greater amount of kernels and a smaller amount of cob, will it not?

PROF. GARDNER: That does not represent the production per acre. A man might produce eighty bushels of the shallow grained variety against seventy of the other. If you will look at our score card, however, you will find that we allow for the corn rather than the cob.

A Member: What is there about self-pollination? That is the principle upon which our best cattle breeding is being conducted. If you want to perpetuate strain, it seems to me that advantage should be taken of this principle.

PROF. GARDNER: If it did not happen to be corn, you could probably do it. With any plant that is self-fertilized you could do it, but corn is strictly a cross fertilized plant. A number of experiments testing the effect of self-fertilization in corn show conclusively that it is very injurious.

A Member: Let me give you an example: The Spaniards brought the Andalusian horse over into Mexico. The escaped horses from them inter-bred and produced the Broncho, and there is no tougher horse than the Broncho. These stallions bred to their own daughters, to their "sister, their cousins, and their aunts," and the result is that there is no tougher horse to-day than this Broncho.

PROF. GARDNER: But you can also carry the principle to such an extent in breeding live stock so as to produce a weak animal.

A Member: It is a case of the survival of the fittest.

PROF. GARDNER: But that may be carried too far.

A Member: While in corn it is the desire of the grower to have the greatest possible depth of grain with the smallest amount of cob, is it not possible that this may be carried to extremes? Is there not a greater feeding value to the cob than is supposed, ninety-nine times out of a hundred? I don't recall the feeding value of the cob, but I believe it is larger than is generally supposed.

PROF. GARDNER: It is very low. But we don't want the cob too small. We want the diameter of the cob to equal one-half the diameter of the ear. We want a cob big enough to hold all the grain that the plant is capable of developing.

A Member: Do you think you can produce two ears to the stalk without losing any of the food value, or losing the value of the ear in fertility?

PROF. GARDNER: Well, it is possible to produce two ears to the stalk by simply selecting. As to the second part, I don't know that I quite understand what you have reference to.

A Member: Whether it is possible to produce two perfect ears without loss of value in one of those ears from the quality of the fodder?

PROF. GARDNER: I don't believe that makes much difference. The one ear stalk is probably better than the two ear stalk. The two ear stalk produces a relatively smaller ear.

A Member: But if you could produce a two ear stalk, could you not increase the fertility, so as to make the two ear stalk of the same value as the one ear stalk?

PROF. GARDNER: That is a very pretty theory, but I don't know.

A Member: Now, we must object to this small grain because it is too hard for the horses to chew it. I want to know whether it is not a waste of material to feed it to horses at all?

PROF. GARDNER: That is out of my line.

A Member: Where can we find a score card?

PROF. GARDNER: It was given in last year's report.

A Member: What is your advice regarding the cultivation of corn after it has tasseled?

PROF. GARDNER: In a very dry season I have known cases where it was of very great benefit to give shallow cultivation even after the tasseling period.

A Member: Up in Monroe county, where I farm, I planted a field half in yellow corn, and half in a deep red, and when I came to harvest it I found a number of ears of a peculiar bronze shade, which is, I think, the most perfect corn I have ever seen. I have kept these bronze ears for seed. Now, in planting, do you think they will come true?

PROF. GARDNER: The larger part of it will probably revert back, but by selecting in this way for some years, you will probably be able to fix that characteristic.

A Member: Will the corn growing in the tassel produce the same kind of corn?

PROF. GARDNER: Yes; the corn growing in the tassel was probably the original form of corn. The occasional occurrence of corn in the tassel is probably a reversion to the original type.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

WHEREAS: A new form of milk contest, designated as "canned milk," was introduced at this meeting, and

WHEREAS: Dr. Jos. F. Neff, Director of Public Health and Chief Milk Inspector David Clegg, and their assistants gave most valuable aid in collecting samples, and making the contest an unqualified success, be it

RESOLVED: That a vote of thanks be extended to these gentlemen by this organization for their services.

WHEREAS: The Milk Exchange of the city of Philadelphia has rendered most valuable assistance and co-operation at this meeting, and

WHEREAS: They arranged for a milk contest among the patrons shipping milk to Philadelphia, and offered a hundred dollars in prizes to encourage dairymen to exhibit, be it

RESOLVED: That the members of the Dairy Union tender their thanks to this organization, which is doing such valuable work in this city.

RESOLVED: That the members of the Dairy Union tender their thanks to all the speakers at this meeting, to the local press, and all others who helped to make this meeting in Philadelphia one of the best, if not the best, in its history.

WHEREAS: The Dairy Division of the United States Department of Agriculture has rendered valuable assistance at our meeting by sending Mr. R. D. White and Mr. Helmer Rabild to address our meeting and score the milk.

RESOLVED: That we hereby tender our thanks to the Secretary of Agriculture for the valuable assistance offered by these men.

WHEREAS: Dr. Louis A. Klein, Dean of the School of Veterinary Medicine, University of Pennsylvania, and Doctors Marshall, Gay, and their colleagues, through their valuable assistance and co-operation, made possible the livestock exhibits and helped to make our meeting a success, be it

RESOLVED: That the thanks of the Association be extended to these gentlemen for their most excellent work.

WHEREAS: Dr. H. C. Campbell gave most valuable assistance in the milk contest by the chemical and bacteriological examinations of it, be it

RESOLVED: That we extend a vote of thanks to him for his most valuable services. And be it further

RESOLVED: That the thanks of this Association be extended to Dr. Thomas F. Hunt and Prof. Gardner, of the State College, for judging the corn; to Mr. J. B. McLaughlin, of Columbus, Ohio, and Mr. R. Penn Smith, of Strafford, for judging the horses.

WHEREAS: The public is becoming educated to the relation between unhealthy cattle and unwholesome milk, and

WHEREAS: Cattle breeders and milk producers are beginning to realize that tuberculosis in their herds lessens materially their profits, and

WHEREAS: The present conditions relating to the control of tuberculin testing, the indemnity for loss on cattle slaughtered to prevent the spreading of tuberculosis and the prevention of the sale of unwholesome milk, are incomplete because of changes in conditions, and the appropriations made heretofore for carrying into effect these provisions have been insufficient, and

WHEREAS: Legislation on these subjects requires most careful consideration in order that cattle owners may not be subjected to irreparable loss; that funds of the State may be spent to full advantage, and that the public may be adequately protected from the sale of unwholesome milk, be it

RESOLVED: That the Pennsylvania Dairy Union appoints a committee of three, and that it requests the appointment of a similar committee by the Pennsylvania Livestock Breeders Association, the Pennsylvania State Veterinary Medicine Association, and the State Medical Association, and that these committees act jointly and in conjunction with the State Livestock Sanitary Board and recommend to the Legislature suitable and adequate legislation relating to the control of tuberculin testing, sufficient indemnity for cattle slaughtered to prevent the spreading of tuberculosis, and the prevention of the sale of unwholesome milk, and that upon the passage of this resolution, the Secretary shall send a copy of the same to the Secretary of each Association named therein.

WHEREAS: The fraudulent sale of oleomargarine is a serious menace to the legitimate market for honest butter, and

WHEREAS: Present laws have proved inadequate to prevent fraud; therefore be it

RESOLVED: That this Association urge its members, and all engaged in the dairy industry to aggressive action in support of the National Dairy Union in its fight against the fraudulent sale of oleo.

(Signed),

H. E. VAN NORMAN.

DR. CHAS. M. SETTZER.

C. B. LANE.

J. E. DODGE.

THOMAS SHARPLESS.

CARCASS DEMONSTRATION.

By PROF. S. W. DOTY, *State College, Pa.*

This carcass demonstration, as I understand it, was to be upon the program of your meeting to give you an opportunity to study the good and bad points of the mutton and beef carcasses, and, inasmuch as these are the carcasses of the animals that were judged on foot the other day, it should show something of what is necessary in the live animal to produce the best carcasses.

We will take the mutton carcass demonstration first: The most important cuts of the lamb carcass are the leg, loin and rack, named in order of value. Formerly, the saddle, which includes the loin, was the most important cut and the leg was not considered quite as valuable, but today things are somewhat changed and the leg of lamb is now in greater demand than either the saddle or the rack, and it is also higher priced on most markets. The breeds that show the greatest development in the regions of the high-priced cuts are of course considered the most valuable for mutton purposes and we find this condition to a greater or less extent in any of the strictly mutton breeds of sheep. The sheep should be developed in the regions of the cheaper cuts—brisket and neck for instance—only sufficiently to give symmetry of form.

Before cutting the carcass, the principal things to note are the covering, the general quality and the confirmation of the carcass. By covering we mean the amount of fat there is over the fleshing part of the carcass. We want that evenly laid on, and well distributed in a firm, medium thick layer, not patchy. Sometimes we find a heavy layer of fat across the loins and back or down on the sides, a condition very much objected to by butchers. Quality is indicated in the carcass by the general make-up thereof. It is also indicated by the appearance of the meat fibre and general covering.

Of the two carcasses before you, the Shropshire is a little more compact and, perhaps a little smoother. I think it has not quite as much leg in proportion to the size of the animal as the Tunis-Dorset,

and for that reason may not be quite as valuable but I think it shows more general quality. Both are, however, deficient in the leg. They don't carry down far enough. The Shropshire is not as thick as the Tunis in the lower part, along the line of the breast, where you want it to be light.

In the Tunis carcass we have the heavy tail-head which is characteristic of that breed, and it is also not quite as fat. He is somewhat roughly covered and a little thin at the shoulders. It is, in fact, a little coarse, and the Shropshire is not finished quite sufficiently. The Tunis is somewhat large in the neck. That is long and heavy, while the Shropshire is somewhat more compact in this part and therefore lighter. I should judge that the neck of this Shropshire weighs about three-quarters of a pound, which is about what we desire. The Shropshire neck is small and slopes right into the shoulder. The Tunis would have to be cut off higher up, and that is waste. To sum it up I would say that the Shropshire carcass shows up a little the better from the butcher's standpoint.

Now, are there any questions? I am going to cut them up into wholesale cuts according to the Chicago methods, which I understand are somewhat different from those of Philadelphia. Before going on with the cutting, however, I might remark about the different methods of dressing. We have the backsetting as is seen in the Tunis carcass and the round dressing as is seen in the Shropshire carcass. Either are good but the latter does not show up the inside of the carcass as well. The back setting method is usually used on lambs and the round dressing on sheep.

In cutting up a lamb, it is sometimes first split in halves, then again it is cut without splitting. When not split the entire loin makes the saddle of the lamb, and the last three ribs on each side make up the rack. If split, the rack and loin are cut into chops. The first cut to make is to remove the cheap cuts, and that is done by cutting into the flank at the stifle joint here and cutting to the point of the last rib. Then we cut up to the forearm here, leaving the forearm on the point of the brisket. Now, in that cut you have the cheap meat removed. It comprises the flank, the lower part of the brisket, and the forearm. As I said before, it is desirable to have that as light as possible. In Philadelphia they have a different method of cutting both beef and mutton. I have never had occasion to see it done. The method of cutting I have shown you here is the one employed at practically all of the market centers except Philadelphia. Now, you see in removing the shoulder in this way, you leave no ribs at all in the shoulder cut. This makes what we call a thirteen-rib Philadelphia rack. When cut the other way we have a ten-rib rack, which we consider more desirable. The meat is tenderer as there is not so much articulation in the muscles back of the shoulders. The ten-rib rack will sell for ten cents a pound more than the thirteen-rib rack, inasmuch as it is a more desirable piece of meat. This shows the two different racks; the one known as the Chicago and New York rack, and the other as the Philadelphia rack.

This lamb (the Shropshire), is a little thinly covered over the loin and still not objectionable. People object to an excessive amount of fat on chops.

This Shropshire shows better quality all through. It is a better grade of meat, and it also seems to have a finer grain.

The above are some of the points that will show what weight is put upon the different parts of the carcass on the various markets.

Gentlemen, we have here the carcass of the steer shown on foot the other day. While I did not see him on foot, I should say he was just in good feeder condition and would grade as butcher stock on the market. He has no excessive fat on any part of him, in fact, not enough for the best markets. The first essential in the beef animal is the muscle or fleshing part of the animal, and then the finish of the animal consists of fat in the right places to produce the best results. Now, gentlemen, in the beef animal the cuts of high-priced meat lie along the back and hind quarters. This animal shows a thick round, but he does not carry down well enough behind. In fact, the round is not well enough developed in comparison with the fore quarters. This shoulder is pretty deep down through and it lacks fleshing and finish. You can feel the shoulder bone here. Another thing; it is not thick enough through the "eye of beef" to be a desirable carcass. Now, you will notice the covering. You don't expect to get as much in some places as others but there should be enough to cover the muscle so that it can not be seen. From three-quarters of an inch to an inch of covering is very desirable, and it should be well distributed across the back and along the sides. This animal, as I see it, would have finished up somewhat rough. The fat, for instance, is a little too thick at the butt of the loin and around the tail-head. Another thing about the fat: It should be white and firm. This covering is firm enough, but it is a little too dark colored. You will notice on the score card that the quality of the fat is given certain weight.

The loin is not quite as thick through as we would like to have it; also there is not fleshing enough over the ribs. It is not thick enough to be a desirable carcass.

As I said before, there is a little too much weight down here in the brisket, which is the cheapest cut of meat. While it is not so thick in proportion to the depth, there is too much of it. We desire just enough in this region to bring out the parallelogram conformation of the animal. Anything in excess of that is undesirable. I imagine this animal on foot gave the appearance of being too heavy in front, with the hind quarters not sufficiently thick and heavy; also it must have shown lack of finish.

PROF. COCHEL: From the butcher's standpoint in the Philadelphia market, is this steer in the right condition?

PROF. DOTY: He is not fat enough for that market, I should judge. On the other hand, an excessively fat animal is not desirable on account of there being too much waste. You want just enough fat to make a sweet, juicy, tender meat. If you have too much fat it goes to waste, and if you have not enough, you have a dry, unpalatable piece of meat.

A Member: How much does this steer weigh?

PROF. COCHEL: 960 pounds on foot; I think he weighs now 540, making about 53 per cent.

PROF. DOTY: A good beef animal should dress out at least 58 per cent. to 60 per cent. of carcass. The dressing percentage is regulated to a great degree by the condition of the animal, the fat animal

dressing noticeably higher than the thin one. This is easily understood inasmuch as the weight of the offal remains about the same in either case, with much more weight in the fat carcass. The ability to estimate the approximate dressing of animals is necessary if a butcher expects to buy right.

Quality in the live animal is an important factor in the dressing percentage and no doubt the indications of quality were brought out when the animal was judged on foot. In the carcass, quality is indicated in more or less the same way except that we have other indications to go by, such for instance as the smoothness of the various parts and the condition of the muscle fibres.

The carcass will now be cut into the various wholesale cuts, in accordance with the Chicago methods (the Philadelphia butchers having a method of their own, with which I am not acquainted).

The carcass is first quartered by making the cut between the twelfth and thirteenth ribs. Here (in Philadelphia), all the ribs are left in the front quarter. We, however, cut one rib in the hind quarter to add weight to it and to keep the loin in good shape for cutting steaks.

I would like to call your attention to the "I" of beef. Note please that the muscle is very thin. It should be at least $4\frac{1}{2}$ to 5 inches through and be covered with three-quarters of an inch of fat to be considered good. This cut shows up to a very good advantage, the extent of the marbling in the carcass (by marbling we mean the intermixing of fat with the muscling fibre). This feature of marbling, of which you see very little in this carcass, regulates to a large degree the thickness of the muscling. It is a characteristic of the well-bred beef animal.

Dairy bred animals and grades usually place the fat more on the external and internal surfaces of the carcass. Whereas the beef animal will mix fat with the muscle fibres throughout the carcass, thus making a much more juicy and a sweeter meat.

The wholesale cuts of the fore quarter are the prime ribs. Square chuck, plate, neck and arms, named in order of value. The first cut to make is to start here about ten to twelve inches (depending upon the thickness of the carcass), down from the top of the carcass on the last rib and cut straight across through the lower part of shoulder and brisket, removing the fore arm. This removes the plate and arm from the higher-priced cuts. These latter cuts being used for stews, corning or hamburger.

The next cut to make is to remove the prime ribs. This is done by cutting down between the fifth and sixth ribs, counting from the front, thus leaving the back seven ribs of the front quarter in one piece, as you see here. This is one of the most valuable cuts in the carcass and is used for roasts almost entirely. The roasts from this cut are used as standing, folded or rolled as the case may be.

Next, remove the neck from the square chuck. It is a cheap cut and is used for corning or hamburger. The square chuck may be cut into the following—cross ribs, chuck ribs and shoulder piece.

The hind quarter is made up of the loin, rump and round. We first place the hind quarter on the block with the inside up and strip out the kidney fat. Also remove the flank by cutting from the stifle joint to the point of the rib or a few inches above, depending upon the thickness thereof. Then we turn the quarter over and remove

the loin from the round by making the cut from the rise in the pelvic arch down to the stifle joint. This cut should strike the edge of the hip joint if properly made. Just as you see here.

The loin is the most valuable piece of the carcass and is usually used as steaks. The steaks of the loin are spoken of as follows: The hip bone, sirloin coming from the butt end, the wedge bone sirloin coming next the "T" bone or porterhouse steaks from the front end of the loin.

The rump is removed from the round by cutting across under the pelvic arch. It is used as roasts principally and is a very desirable piece of meat. Following down on the round and cutting parallel to the above cut the round steaks are obtained as shown in this cut.

A Member: Where does the pin bone come in?

PROF. DOTY: That is a cut I am not familiar with.

A Member: In the Philadelphia market we have what we call a pin-bone steak. It is made by cutting right along here. You follow the sirloin in the hip bone.

PROF. DOTY: This gentleman will show you the Philadelphia method of cutting. I am not familiar with it.



APPENDIX.



APPENDIX.

LIST OF PUBLICATIONS OF THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE.

ANNUAL REPORTS.

- *Report of the State Board of Agriculture, 336 pages, 1877.
- *Report of the State Board of Agriculture, 625 pages, 1878.
- *Report of the State Board of Agriculture, 560 pages, 1879.
- *Report of the State Board of Agriculture, 557 pages, 1880.
- *Report of the State Board of Agriculture, 646 pages, 1881.
- *Report of the State Board of Agriculture, 645 pages, 1882.
- *Report of the State Board of Agriculture, 645 pages, 1883.
- *Report of the State Board of Agriculture, 648 pages, 1884.
- *Report of the State Board of Agriculture, 645 pages, 1885.
- *Report of the State Board of Agriculture, 646 pages, 1886.
- *Report of the State Board of Agriculture, 650 pages, 1887.
- *Report of the State Board of Agriculture, 648 pages, 1888.
- *Report of the State Board of Agriculture, 650 pages, 1889.
- *Report of the State Board of Agriculture, 594 pages, 1890.
- *Report of the State Board of Agriculture, 600 pages, 1891.
- *Report of the State Board of Agriculture, 640 pages, 1892.
- *Report of the State Board of Agriculture, 713 pages, 1893.
- *Report of the State Board of Agriculture, 646 pages, 1894.
- *Report of the Department of Agriculture, 378 pages, 1895.
- *Report of the Department of Agriculture, Part 1, 820 pages, 1896.
- *Report of the Department of Agriculture, Part 2, 444 pages, 1896.
- *Report of the Department of Agriculture, Part 1, 897 pages, 1897.
- *Report of the Department of Agriculture, Part 2, 309 pages, 1897.
- *Report of the Department of Agriculture, 894 pages, 1898.
- *Report of the Department of Agriculture, Part 1, 1082 pages, 1899.
- *Report of the Department of Agriculture, Part 2, 368 pages, 1899.
- *Report of the Department of Agriculture, Part 1, 1010 pages, 1900.
- *Report of the Department of Agriculture, Part 2, 348 pages, 1900.
- *Report of the Department of Agriculture, Part 1, 1040 pages, 1901.
- *Report of the Department of Agriculture, Part 2, 464 pages, 1901.
- *Report of the Department of Agriculture, Part 1, 1030 pages, 1902.
- *Report of the Department of Agriculture, Part 2, 324 pages, 1902.
- *Report of the Department of Agriculture, 958 pages, 1903.
- *Report of the Department of Agriculture, 790 pages, 1904.
- Report of the Department of Agriculture, 846 pages, 1905.
- Report of the Department of Agriculture, 690 pages, 1906.
- Report of the Department of Agriculture, 565 pages, 1907.
- Report of the Department of Agriculture, 690 pages, 1908.
- Report of the Department of Agriculture, 806 pages, 1909.

BULLETINS.

- No. 1.* Tabulated Analyses of Commercial Fertilizers, 24 pages, 1895.
- No. 2.* List of Lectures of Farmers' Institutes, 36 pages, 1895.
- No. 3.* The Pure Food Question in Pennsylvania, 38 pages, 1895.
- No. 4.* Tabulated Analyses of Commercial Fertilizers, 22 pages, 1896.
- No. 5.* Tabulated Analyses of Commercial Fertilizers, 38 pages, 1896.

*NOTE.—Edition exhausted.

- No. 6.* Taxidermy; How to Collect Skins, etc., 128 pages, 1896.
 No. 7.* List of Creameries in Pennsylvania, 68 pages, 1896.
 No. 8.* Report of State Horticultural Association, 108 pages, 1896.
 No. 9.* Report of Dairymen's Association, 96 pages, 1896.
 No. 10.* Prepared Food for Invalids and Infants, 12 pages, 1896.
 No. 11.* Tabulated Analyses of Commercial Fertilizers, 22 pages, 1896.
 No. 12.* Road Laws for Pennsylvania, 42 pages, 1896.
 No. 13.* Report of Butter Colors, 8 pages, 1896.
 No. 14.* Farmers' Institutes in Pennsylvania, 92 pages, 1896.
 No. 15.* Good Roads for Pennsylvania, 42 pages, 1896.
 No. 16.* Dairy Feeding as Practiced in Pennsylvania, 126 pages, 1896.
 No. 17.* Diseases and Enemies of Poultry, 128 pages, 1896.
 No. 18.* Digest of the General and Special Road Laws for Pennsylvania, 130
pages, 1896.
 No. 19.* Tabulated Analyses of Commercial Fertilizers, 40 pages, 1896.
 No. 20.* Preliminary Report of Secretary, 126 pages, 1896.
 No. 21.* The Township High School, 24 pages, 1897.
 No. 22.* Cider Vinegar of Pennsylvania, 28 pages, 1897.
 No. 23.* Tabulated Analyses of Commercial Fertilizers, 31 pages, 1897.
 No. 24.* Pure Food and Dairy Laws of Pennsylvania, 19 pages, 1897.
 No. 25.* Farmers' Institutes in Pennsylvania, 8 pages, 1897.
 No. 26.* Farmers, Institutes in Pennsylvania, 74 pages, 1897.
 No. 27.* The Cultivation of American Ginseng, 23 pages, 1897.
 No. 28.* The Fungous Foes of the Farmer, 19 pages, 1897.
 No. 29.* Investigations in the Bark of Trees, 17 pages, 1897.
 No. 30.* Sex in Plants, 17 pages, 1897.
 No. 31.* The Economic Side of the Mole, 42 pages, 1898.
 No. 32.* Pure Food and Dairy Laws, 30 pages, 1898.
 No. 33.* Tabulated Analyses of Commercial Fertilizers, 42 pages, 1898.
 No. 34.* Preliminary Report of the Secretary, 150 pages, 1898.
 No. 35.* Veterinary Medicines, 23 pages, 1898.
 No. 36.* Constitutions and By-Laws, 73 pages, 1898.
 No. 37.* Tabulated Analyses of Commercial Fertilizers, 40 pages, 1898.
 No. 38.* Farmers' Institutes in Pennsylvania, 8 pages, 1898.
 No. 39.* Farmers' Institutes in Pennsylvania, 88 pages, 1898.
 No. 40.* Questions and Answers, 206 pages, 1898.
 No. 41.* Preliminary Reports of the Department, 189 pages, 1899.
 No. 42.* List of Creameries in Pennsylvania, 88 pages, 1899.
 No. 43.* The San Jose Scale and other Scale Insects, 22 pages, 1899.
 No. 44.* Tabulated Analyses of Commercial Fertilizers, 62 pages, 1899.
 No. 45.* Some Harmful Household Insects, 13 pages, 1899.
 No. 46.* Some Insects Injurious to Wheat, 24 pages, 1899.
 No. 47.* Some Insects Attacking Fruit, etc., 19 pages, 1899.
 No. 48.* Common Cabbage Insects, 14 pages, 1899.
 No. 49.* Methods of Protecting Crops, etc., 20 pages, 1899.
 No. 50.* Pure Food and Dairy Laws of Pennsylvania, 33 pages, 1899.
 No. 51.* Tabulated Analyses of Commercial Fertilizers, 69 pages, 1899.
 No. 52.* Proceedings Spring Meeting of Round-up Meeting, Farmers' Insti-
tute Managers, etc., 296 pages, 1899.
 No. 53.* Farmers' Institutes in Pennsylvania, 1899-1900, 94 pages, 1899.
 No. 54.* Tabulated Analyses of Commercial Fertilizers, 163 pages, 1899.
 No. 55.* The Composition and Use of Fertilizers, 126 pages, 1899.
 No. 56.* Nursery Fumigation and the Construction and Management of the
Fumigating House, 24 pages, 1899.
 No. 57.* The Application of Acetylene Illumination to Country Homes, 85
pages, 1899.
 No. 58.* The Chemical Study of the Apple and its Products, 44 pages, 1899.
 No. 59.* Fungous Foes of Vegetable Fruits, 39 pages, 1899.
 No. 60.* List of Creameries in Pennsylvania, 33 pages, 1899.
 No. 61.* The Use of Lime in Pennsylvania Soils, 170 pages, 1900.
 No. 62.* A Summer's Work Abroad in School Grounds, Hotme Grounds, Play
Grounds, Parks and Forests, 34 pages, 1900.
 No. 63.* A Course in Nature Study for Use in the Public Schools, 119 pages,
1900.
 No. 64.* Nature Study Reference Library for Use in the Public Schools, 22
pages, 1900.
 No. 65.* Farmers' Library List, 29 pages, 1900.
 No. 66.* Pennsylvania Road Statistics, 98 pages, 1900.
 No. 67.* Methods of Steer Feeding, 14 pages, 1900.
 No. 68.* Farmers' Institutes in Pennsylvania, 90 pages, 1900.
 No. 69.* Road Making Materials of Pennsylvania, 104 pages, 1900.
 No. 70.* Tabulated Analyses of Commercial Fertilizers, 97 pages, 1900.
 No. 71.* Consolidation of Country Schools and the Transportation of
Scholars by use of Vans, 89 pages, 1900.
 No. 72.* Tabulated Analyses of Commercial Fertilizers, 170 pages, 1900.
 No. 73.* Synopsis of the Tax Laws of Pennsylvania, 132 pages, 1901.
 No. 74.* The Repression of Tuberculosis of Cattle by Sanitation, 24 pages,
1901.

- No. 75.* Tuberculosis of Cattle, and the Pennsylvania Plan for its Representation, 263 pages, 1901.
- No. 76. Co-operative Investigation into the Agricultural Seed Supply of Pennsylvania, 50 pages, 1901.
- No. 77.* Bee Culture, 101 pages, 1901.
- No. 78.* List of County and Local Agricultural Societies, 10 pages, 1901.
- No. 79. Rabies, 28 pages, 1901.
- No. 80.* Decisions of the Department of Agriculture on the Pure Food Act of 1895, 20 pages, 1901.
- No. 82.* Containing the Law Creating a Department of Agriculture in Pennsylvania, and giving the Various Acts of Assembly Committed to the Department for Enforcement; Together with Decisions and Standards Adopted with Reference to the Pure Food Act of 1895, 90 pages, 1901.
- No. 83.* Tabulated Analyses of Commercial Fertilizers, 132 pages, 1901.
- No. 84. Methods of Steer Feeding; the Second Year of Co-operative Experiment by the Pennsylvania State Department of Agriculture and the Pennsylvania State College Agricultural Experiment Station, 16 pages, 1901.
- No. 85.* Farmers' Institute of Pennsylvania, 102 pages, 1901.
- No. 86.* Containing a Complete List of Licenses granted by the Dairy and Food Commissioner, from January 1, 1901, to July 1, 1901, etc., 422 pages, 1901.
- No. 87.* Giving Average Composition of Feeding Stuffs, 42 pages, 1901.
- No. 88.* List of Creameries in Pennsylvania, 33 pages, 1901.
- No. 89.* Tabulated Analyses of Commercial Fertilizers, 195 pages, 1901.
- No. 90. Treatment of San Jose Scale in Orchard and Nursery, 33 pages, 1902.
- No. 91. Canning of Fruits and Vegetables, 57 pages, 1902.
- No. 92.* List of Licenses Granted by the Dairy and Food Commissioner, 193 pages, 1902.
- No. 93.* The Fundamentals of Spraying, 35 pages, 1902.
- No. 94. Phosphates—Phosphatic or Phosphoric Acid Fertilizers, 87 pages, 1902.
- No. 95.* County and Local Agricultural Societies, 12 pages, 1902.
- No. 96. Insects Injurious to Cucurbitaceous Plants, 31 pages, 1903.
- No. 97. The Management of Greenhouses, 41 pages, 1902.
- No. 98. Bacteria of the Soil in their Relation to Agriculture, 88 pages, 1902.
- No. 99. Some Common Insect Pests of the Farmer, 32 pages, 1902.
- No. 100.* Containing Statement of Work of Dairy and Food Division from January 1, 1902, to June 30, 1902, 223 pages, 1902.
- No. 101. Tabulated Analyses of Commercial Fertilizers, 137 pages, 1902.
- No. 102. The Natural Improvement of Soils, 50 pages, 1902.
- No. 103.* List of Farmers' Institutes of Pennsylvania, 67 pages, 1902.
- No. 104. Modern Dairy Sience and Practice, 127 pages, 1902.
- No. 105.* Potato Culture, 9 pages, 1902.
- No. 106.* The Varieties of Fruit that can be Profitably Grown in Pennsylvania, 50 pages, 1902.
- No. 107.* Analyses of Concentrated Commercial Feeding Stuffs, 62 pages, 1903.
- No. 108. The Hessian Fly (never printed).
- No. 109.* Tabulated Analyses of Commercial Fertilizers, 208 pages, 1903.
- No. 110.* Containing Statement of Work of Dairy and Food Division from July 1, to December 31, 1903, 248 pages, 1903.
- No. 111.* Small Fruits, their Origin, Culture and Marketing, 66 pages, 1903.
- No. 112.* List of County and Local Agricultural Societies, 10 pages, 1903.
- No. 113. Methods of Milking, 96 pages, 1903.
- No. 114.* Tabulated Analyses of Commercial Fertilizers, 116 pages, 1903.
- No. 115. Proceedings of Annual Meeting of Farmers' Institute Managers and Lecturers, 210 pages, 1903.
- No. 116.* Farmers' Institutes in Pennsylvania, Season 1903-1904, 64 pages, 1903.
- No. 117. Potash Fertilizers—Sources and Methods of Application, 46 pages, 1903.
- No. 118.* Containing the Laws Creating the Office of Dairy and Food Commissioner in Pennsylvania, and also a Digest of the Acts of Assembly Committed to his Administration, 62 pages, 1903.
- No. 119.* Tabulated Analyses of Commercial Fertilizers, 115 pages, 1903.
- No. 120. The Apple-tree Tent-caterpillar, 46 pages, 1903.
- No. 121. Address of Hon. Joseph W. Hunter, State Highway Commissioner, Delivered at Annual Meeting of State Board of Agriculture, January 28, 1904, 16 pages, 1903.
- No. 122.* Analyses of Concentrated Commercial Feeding Stuffs, 52 pages, 1904.
- No. 123. Chestnut Culture, 50 pages, 1904.
- No. 124.* County and Local Agricultural Fairs, 10 pages, 1904.
- No. 125. The Source and Nature of Bacteria in Milk, 41 pages, 1904.
- No. 126.* Tabulated Analyses of Commercial Fertilizers, January 1, to August 1, 140 pages, 1904.
- No. 127.* Farmers' Institutes in Pennsylvania, 71 pages, 1904.

- No. 128. Grape Culture, 62 pages, 1904.
 No. 129. Alfalfa Culture in Humid Land, 64 pages, 1904.
 No. 130. The Cow-pea in the North, 41 pages, 1904.
 No. 131. Proceedings, State Board of Agriculture and Farmers' Normal Institute, 260 pages, 1904.
 No. 132.* Analyses of Commercial Fertilizers, August 1, to December 31, 70 pages, 1904.
 No. 133.* The Improvement of Corn in Pennsylvania, 76 pages, 1904.
 No. 134. Proceedings of the Twenty-eighth Annual Meeting of the State Board of Agriculture, 152 pages, 1905.
 No. 135.* Analyses of Concentrated Feeding Stuffs, 41 pages, 1905.
 No. 136.* List of County and Local Agricultural Societies, 8 pages, 1905.
 No. 137. Proceedings, Spring Meeting State Board of Agriculture and Farmers' Annual Normal Institute, 216 pages, 1905.
 No. 138.* Analyses Concentrated Commercial Fertilizers, January 1, to August 1, 106 pages, 1905.
 No. 139.* Farmers' Institutes in Pennsylvania, 1905-1906, 93 pages, 1905.
 No. 140. Sheep Husbandry, 69 pages, 1905.
 No. 141.* Laws Relating to the Dairy and Food Division, 47 pages, 1905.
 No. 142.* Analyses Concentrated Commercial Fertilizers, August 1, to December 31, 61 pages, 1905.
 No. 143. Poultry in Pennsylvania, 36 pages, 1906.
 No. 144. Proceedings of 29th Annual Meeting State Board of Agriculture, 191 pages, 1906.
 No. 145.* Commercial Feeding Stuffs in Pennsylvania, 51 pages, 1906.
 No. 146.* List of County and Local Agricultural Societies, 10 pages, 1906.
 No. 147. Market Gardening, 53 pages, 1906.
 No. 148. Report of Bee-Keepers' Association of Pennsylvania, 57 pages, 1906.
 No. 149.* Analyses Commercial Fertilizers, January 1, August 1, 1906, 80 pages, 1906.
 No. 150.* Farmers' Institutes in Penna., for the year 1906-1907, 73 pages, 1906.
 No. 151. Proceedings Spring Meeting of State Board of Agriculture and Farmers' Annual Normal Institute, 190 pages, 1906.
 No. 152. Fruit of Pennsylvania, 330 pages, 1906.
 No. 153.* Analyses Commercial Fertilizers, August 1-December 31, 1906, 60 pages, 1906.
 No. 154.* Proceedings State Board of Agriculture for 1907, 158 pages, 1907.
 No. 155.* Commercial Feeding Stuffs of Pennsylvania for 1906, 47 pages, 1907.
 No. 156.* List of County and Agricultural Fairs for 1907, 10 pages, 1907.
 No. 157. Proceedings of Farmers' Normal Institute and State Board of Agriculture, 210 pages, 1907.
 No. 158.* Farmers' Institutes for year 1907-1908, 78 pages, 1907.
 No. 159.* Analyses of Commercial Fertilizers of Spring Samples, 69 pages, 1907.
 No. 160.* Laws Relating to Dairy and Food Division, 69 pages, 1907.
 No. 161. Papers Read at Farmers' Institutes, 1906-1907, 124 pages, 1907.
 No. 162.* Breakfast Foods, 40 pages, 1907.
 No. 163.* Analyses of Commercial Fertilizers from Fall Samples, 51 pages, 1907.
 No. 164. Proceedings State Board of Agriculture, 1908, 210 pages, 1908.
 No. 165.* List of County and Agricultural Fairs, 1908, 10 pages, 1908.
 No. 166. Results of the Analyses of Paris Green, 6 pages, 1908.
 No. 167.* Analyses of Commercial Feeding Stuffs, for 1907, 98 pages, 1908.
 No. 168.* Preliminary Report Dairy and Food Commissioner, 50 pages, 1908.
 No. 169. Proceedings Spring Meeting State Board of Agriculture and Annual Farmers' Normal Institute, 214 pages, 1908.
 No. 170. Farmers' Institutes for Season of 1908, 84 pages, 1908.
 No. 171.* Analyses of Commercial Fertilizers, January 1, to August 1, 1908, 74 pages, 1908.
 No. 172. The Bang Method for the Repression of Tuberculosis in Cattle, 28 pages, 1908.
 No. 173.* Analyses of Commercial Fertilizers, August 1, to December 31, 1908, 58 pages, 1908.
 No. 174. List of Fertilizer Manufacturers, 1909, 32 pages, 1909.
 No. 175. Analyses of Commercial Feeding Stuffs, 1908, 148 pages, 1909.
 No. 176. Analyses of Paris Green, 1908, 31 pages, 1909.
 No. 177. Proceedings State Board of Agriculture, 180 pages, 1909.
 No. 178.* List of County and Local Agricultural Fairs, 10 pages, 1909.
 No. 179. Papers Read at Farmers' Institutes, 1907-1908, 105 pages, 1909.
 No. 180. Laws Dairy and Food Bureau, 69 pages, 1909.
 No. 181. Timely Hints to Horsebreeders, 23 pages, 1909.
 No. 182. Proceedings Farmers' Annual Normal Institute and Spring Meeting State Board of Agriculture, 231 pages, 1909.

- No. 183.* Report of Dairy and Food Bureau, 57 pages, 1909.
No. 184.* Farmers' Institutes for Pennsylvania, 1909, 79 pages, 1909.
No. 185. Analyses of Commercial Fertilizers, January 1, to August 1, 1909,
87 pages, 1909.
No. 186. Swine Husbandry, 127 pages, 1909.
No. 187. Directory of Stallions Registered with Pennsylvania Livestock
Sanitary Board, for 1909, 86 pages, 1909.
No. 188. Principles of Domestic Science, 42 pages, 1909.
No. 189. Analyses of Commercial Fertilizers, August 1, to December 31,
1909, 71 pages, 1909.

*NOTE.—Edition exhausted.

FERTILIZER VALUATIONS—1909.

The object of an official valuation of commercial fertilizers is to enable the consumer to judge approximately whether he has been asked to pay for a given brand more than the fertilizing ingredients it contains and market conditions prevailing at the time would warrant. It is clear, therefore, that no attempt is made in this valuation to indicate whether the fertilizer valued possesses a greater or less crop-producing capacity than another fertilizer; but only whether it is higher priced than another of the same general composition.

For this purpose the valuation must be so computed as to include all the elements entering into the cost of a fertilizer as it is delivered to the consumer. These elements may be conveniently grouped as follows:

1. The wholesale cost of the ingredients.

2. The jobbers' gross profit on the sale of the ingredients; this includes office expenses, advertising, losses, etc., for the purpose of the present computation it may be assumed that the sum of this gross profit and the wholesale cost of the ingredients, is equivalent to the retail price of the single ingredients near the wholesale markets in ton lots of original packages for cash.

3. The expense and profit of mixing: This item applies only to complete fertilizers, rock and potash, and ammoniated rock; not to dissolved or ground bone, or to dissolved rock.

4. The expense and profit of bagging.

5. Agents' commission: This item includes not only the commission proper, but every advance in price due to the sale of the goods through an agent in small quantities on time, rather than directly to the consumer in ton lots for cash.

6. Freight from the wholesale market to the point of delivery.

The valuations for 1908 were based: .

1. Upon the wholesale prices from September 1, 1907, to March 1, 1908, of the raw materials used in fertilizer manufacture, the quotations of the New York market being adopted for all materials except acidulated phosphate rock and ground bone.

2. Upon an allowance of 20 per cent. of the wholesale prices, above mentioned, to cover jobbers' profit.

By adding the 20 per cent. allowed for jobbers' gross profit to the wholesale price of the several raw materials, the retail price in original packages at the jobbers' warehouse is obtained.

Since the amount of the several valuable fertilizing constituents in the various raw materials is known, it is a simple matter to determine the corresponding retail value per pound of the valuable fertilizing constituents yielded by each raw material. A schedule of these pound values affords a convenient basis of computation of the value per ton of various fertilizers, whose computation is ascertained by analysis.

The values assigned, for the present, to the other elements in the cost of the fertilizer at the point of delivery are:

3. For mixing, \$1.00 per ton.

4. For bagging, \$1.00 per ton, in all cases except those in which the article was sold in original packages; the cost of the package being, in such cases, included in the wholesale price.

5. For agents' commission, 20 per cent. of the cost of the goods f. o. b. at the jobbers' or mixers' warehouse.

6. For freight, \$2.00 per ton; the cost of the freight in lots of twelve tons or over, from the seaboard to Harrisburg, averaging \$1.88 per ton.

The following valuation of dissolved South Carolina rock illustrates the method:

Phosphoric acid.	Per cent.	Weight per ton.
Soluble,	11.50	230 lbs. at 3c. \$6 90
Reverted,	2.50	50 lbs. at 2½c. 1 25
Insoluble,	1.00	20 lbs. at 1½c. 30
 Retail cash value of ingredients,		\$8 45
Bagging,		1 00
 Cash value of goods ready for shipment,		\$9 45
Agents' commission, 20 per cent.,		1 89
Freight,		2 00
 Commercial value per ton,		\$13 34

It is not to be expected, of course, that the valuations thus computed will precisely represent the fair price to be charged for a brand in each locality and in every transaction. Market conditions, competition, distance from factory, all introduce minor variations. Nevertheless, to make the approximation reasonably close the average valuation of a given class of goods ought to agree closely with its ascertained average selling price. Whenever such an agreement is no longer obtained by the use of a schedule, it is evident that the schedule of retail values of the constituents, or the added allowances for mixing, etc., requires revision.

It is needful to note here another factor greatly affecting the practical accuracy of these approximations. Their computations would offer little difficulty and their usefulness be far greater, if, by the ordinary methods of analysis, the exact nature of the ingredients used to supply the several fertilizer constituents, were capable of certain determination. This is, however, possible today to only a limited extent. The valuations are therefore based on the assumption that the fertilizers are uniformly compounded from high quality ingredients, such are commonly employed in the manufacture of fertilizers of the several classes. Consumers should carefully avoid the error of accepting such valuations as infallible; they are not designed to be used for close comparisons of single brands, but only to indicate whether the price asked for a fertilizer is abnormal, assuming good quality for the ingredients used. From this it is clear that, except as high freights may require, the selling price of a brand should not far exceed the valuation; but that a fertilizer may be made of inferior materials and yet have a high valuation.

The valuations used during 1907 were modified for use during 1908 in accordance with the changes in whole sale prices of fertilizing ingredients and to make the valuations more closely follow the selling price.

The following comparative statement shows the valuations and selling prices of the several classes of fertilizers during 1904 and 1908

Fertilizers.	Number of samples.	Valuation.	Selling price.	Difference of valuation from selling price.
Spring, 1904.				
Complete,	349	25.07	24.38	.79
Rock-and-potash,	75	15.45	16.47	-1.02
Dissolved bone,	2	23.42	31.50	-8.08
Ground bone,	22	27.77	28.20	-.43
Dissolved rock,	41	14.06	14.50	-.53
Fall, 1904.				
Complete,	256	22.58	21.82	.71
Rock-and-potash,	68	14.92	15.80	-.97
Dissolved bone,	6	27.77	24.94	2.83
Ground bone,	38	27.07	27.02	.25
Dissolved rock,	45	14.09	13.89	.20
Spring, 1905.				
Complete,	374	25.60	24.08	.97
Rock-and-potash,	89	15.49	16.11	-.62
Dissolved bone,	8	22.70	23.88	-1.13
Ground bone,	37	26.72	29.08	-2.36
Dissolved rock,	47	13.86	13.64	.22
Fall, 1905.				
Complete,	285	22.35	21.30	.96
Rock-and-potash,	74	15.04	15.97	-.97
Dissolved bone,	6	25.85	24.78	1.11
Ground bone,	35	28.70	27.70	1.10
Dissolved rock,	49	13.61	14.21	-.30
Spring, 1906.				
Complete,	412	24.76	23.55	1.21
Rock-and-potash,	90	15.19	16.17	-.96
Dissolved bone,	4	22.65	24.40	-1.75
Ground bone,	34	28.23	29.02	-.79
Dissolved rock,	45	12.98	13.75	-.77
Fall, 1906.				
Complete,	306	22.99	21.87	1.12
Rock-and-potash,	71	15.06	15.76	-.79
Dissolved bone,	7	25.83	22.06	3.27
Ground bone,	34	29.12	27.80	1.32
Dissolved rock,	43	12.99	13.45	-.46
Spring, 1907.				
Complete,	424	26.84	24.60	2.24
Rock-and-potash,	108	16.68	16.94	-.31
Dissolved bone,	6	25.08	22.28	2.80
Ground bone,	27	29.64	31.55	-1.91
Dissolved rock,	41	14.72	14.64	.08
Fall, 1907.				
Complete,	280	24.59	23.71	1.88
Rock-and-potash,	96	15.82	16.58	-.76
Dissolved bone,	8	27.61	23.09	5.52
Ground bone,	36	28.90	28.92	.12
Dissolved rock,	48	14.67	14.76	.09
Spring, 1908.				
Complete,	155	26.23	25.00	.54
Rock-and-potash,	108	16.94	16.96	-.02
Dissolved bone,	4	23.09	21.11	1.98
Ground bone,	21	28.96	29.04	-.08
Dissolved rock,	83	14.92	14.73	.19

Fertilizers.	Number of samples.	Valuation.	Selling price.	Difference of valuation from selling price.
Fall, 1908.				
Complete,	287	23.88	22.84	1.54
Rock-and-potash,	104	16.17	16.43	-.26
Dissolved bone,	6	26.05	22.48	3.57
Ground bone,	30	27.90	29.18	-1.28
Dissolved rock,	49	14.86	14.81	.55

The following statement from the weekly reports of the Oil, Paint and Drug Reporter, of New York City, shows the average wholesale prices of fertilizer raw materials from September 1, 1907, to March 1, 1908, and from September 1, 1908, to March 1, 1909:

Wholesale Prices of Fertilizer Ingredients, New York, Oil, Paint and Drug Reporter.

Substance.	Amount priced.	Average price Sept. 1, 1907, to March 1, 1908.	Average price Sept. 1, 1908, to March 1, 1909.	Prices Sept.-March, 1908-9, in per cent. of prices 1907-8.
Sulphate of ammonia,	Owt.,	3.0844	2.8999	96.5
Nitrate of soda,	Owt.,	2.3883	2.166	90.7
Dried blood, H. G.,	Unite (20 lbs.),	2,4515	2,6587	108.4
Concentrated tankage,	Unit (20 lbs.),	2.357	2.26	95.8
Rough bone,	Ton,	16.94	19.57	115.5
Bone meal,	Ton,	20.94	22.49	107.4
Fish guano dry,	Unit (20 lbs.),	2.80	2.772	99.0
Phosphate rock, Charleston,	Ton,	6.875	6.875	100.0
Phosphate rock, Tennessee,	Ton,	6.58	5.67	86.2
Acid phosphate,	Unit (20 lbs.),	.7146	.5684	79.5
Double manure salt,	Owt.,	1.174	1.165	99.0
Sulphate of potash,	Owt.,	2.9011	2.18	99.0
Kainit,	Ton,	8.35	8.50	96.0
Muriate of potash,	Owt.,	1.961	1.90	96.9
Sulphuric acid 66 degrees B.,	Owt.,	1.3896	1.06	75.6

*Bone phosphate of lime 10 cents per unit.

In ammoniates such as dried blood and fish gunao, the unit is of ammonia, of which 82.35 per cent. is nitrogen; in acid phosphate, the unit is of phosphoric acid (phosphorous pentoxid.)

There has been a falling off in prices of raw materials all along the line. The only materials which show an increase over last year's prices are dried blood and bone. The reduction in price is especially noticeable in case of acid phosphate.

Phosphates:

During March 1908 prices of phosphates were lowered to a greater or less extent. Prices, which were fairly well maintained throughout the balance of the year, were

Charleston ground rock, \$6.75 to \$7.00 per short ton; Florida phosphate at \$4 @ 4.25; Tennessee phosphate, \$5 @ 5.50.

Potash Salts: The reports of the U. S. Bureau of Statistics show the following entries for consumption during the fiscal year 1907 and 1908.

	1907.	1908.
Muriate (pounds),	231,587,378	236,949,002
Kieserit, kainit, etc., (tons),	344,005	329,467

Prices for potash salts have remained practically the same as last year, the schedule being as follows:

Muriate, 80 per cent., per 100 pounds,	1.985
Sulphate, 48 per cent., per 100 pounds,	2.17
Double manure salt, 48-58 per cent., per 100 pounds,	1.15
Kainit, 12.4 per cent., actual potash, per ton,	8.25
Manure salt, 20 per cent. potash, per ton,	14.68

Composition of Raw Materials.—In order to form a correct idea of the cost per pound of the fertilizer constituents of these materials, it is needful to determine their composition or, in other words, the quantities of valuable constituents each contains. The following table shows the composition of the raw materials used in the manufacture of fertilizers. No analysis of these materials, with the exception of ground bone and dissolved rock, have been made in Pennsylvania. The figures in the following table include the averages of the results of analyses made in Connecticut, New Jersey and Massachusetts during the past year, except in the case of ground bone and dissolved rock phosphates, where Pennsylvania results alone are included.

Composition of Non-Acidulated Fertilizer Ingredients. (Per Cent.)

	Number of samples analyzed.	Nitrogen.	Potash.	Total phosphoric acid.
Sulphate of ammonia,	4	20.39		
Nitrate of soda,	17	14.48		
Dried blood,	3	10.56		
Ground bone,	51	2.99		22.08
Tankage,	16	6.12		14.06
Ground fish,	22	8.34		6.79
Cottonseed meal,	173	7.08		
Castor pomace,	17	5.03		
Sulphate of potash, H. G.,	10		49.00	
Muriate of potash,	22		50.67	
Kainit,	3		14.25	
Double sulphate of potash and magnesia,	4		27.35	

Composition of Acidulated Fertilizer Ingredients. (Per Cent.)

	Number of samples analyzed.	Total phosphoric acid.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Nitrogen.
Dissolved bone,	10	12.91	6.28	4.02	2.62	1.67
Dissolved rock phosphate,	82	15.37	9.13	4.73	1.52	.....

Cost per pound of Fertilizer Constituents.—With the composition of these raw materials and their price per ton, hundred weight, or other unit of measure as a basis, the wholesale cost per pound of the valuable constituents can be readily calculated. In many cases the ammoniates are quoted "per unit of ammonia," the term unit being equivalent to per cent.; in goods sold by the ton of 2,000 lbs., the unit is equal to 20 lbs., and 20 lbs., ammoniate contain 16.47 lbs. of nitrogen.

In the case of refuse bone-black, unacidulated, the mean, 28.25 per cent. of phosphoric acid, is assumed to represent the average material on the market.

Phosphate rock is sold by the ton of 2,240 lbs., and on the basis of the bone phosphate of lime it contains, with drawbacks for injurious constituents. Bone-phosphate of lime contains 45.8 per cent. of phosphoric acid; therefore, each per cent. of bone phosphate in a long ton is equivalent to 22.4 lbs., and contains 10.26 lbs., of phosphoric acid.

In the wholesale trade, dried blood, azotine, concentrated tankage and hoof meals are usually sold on the basis of ammonia, disregarding the phosphoric acid present.

Insoluble phosphoric acid in dissolved rock is likewise omitted from consideration, contracts being based solely upon the "available" phosphoric acid; nor in rock phosphates is any claim made for the small quantities of nitrogen and potash they contain, nor in dissolved bone for the potash present.

Under these conditions, the wholesale cost per pound in New York of the valuable constituents of such materials as furnish but a single fertilizing element, these materials being assumed to be in the state of preparation and in the packing in which the manufacturer purchased them, are given in the following table; also a figure representing a fair retail price at the factory, the materials having undergone no change in treatment or packing and the allowance for expenses and profit in retailing being 20 per cent.

Wholesale Cost Per Pound of Fertilizer Constituents. (New York.)

1. Ingredients Supplying One Constituent.

Materials.	Constituent Valued.	Wholesale price, cents.	Wholesale price plus 20 per cent.
Sulphate of ammonia,	Nitrogen,	14.22	17.06
Nitrate of soda,	Nitrogen,	14.06	17.06
Dried blood, H. G.,	Nitrogen,	16.14	19.37
Concentrated tankage,	Nitrogen,	18.72	18.46
Phosphate rock.*			
Tennessee, 78 per cent.	Phosphoric acid, total,	.700	.86
South Carolina, 60 per cent.,	Phosphoric acid, total,	1.12	1.34
Acid phosphate,	Phosphoric acid, available,	2.843	3.41
Double manure salts,	Potash,	4.48	5.51
Sulphate of potash,	Potash,	4.58	5.42
Muriate of potash,	Potash,	3.78	4.48
Kainit,	Potash,	2.97	3.56

*The prices of phosphate rock are f. o. b. at the respective points of shipment, not New York. The prices for potash are taken from the schedule of the syndicate, and those of the remainder from the Oil, Paint and Drug Reporter.

The value of nitrogen is based upon quotations for concentrated tankage as outlined a year ago. This value is \$2.674 per unit of ammonia, which is equivalent to \$3.25 per unit of nitrogen.

The average composition of the ground bone and bone meal samples analyzed last fall in Pennsylvania was: Phosphoric acid, 22.15 per cent.; nitrogen, 3.03 per cent.

The prepared bone contains less fat and moisture, and often less nitrogen than ordinary rough bone, but these differences tend, in a measure to neutralize each other. Assuming for the rough bone quoted in the New York market the same composition as the bone meal sold in Pennsylvania and for the value of the nitrogen \$3.25 per unit, as previously stated, the values per pound of the several constituents would be:

Wholesale cost per Pound of Fertilizer Constituents, New York.

II. Bone.

	Constituent Valued.	Wholesale price, cents.	Wholesale price plus 20 per cent.
Rough bone,	Nitrogen,	16.25	19.50
	Phosphoric acid,	2.194	2.88
Ground bone,	Nitrogen,	18.67	22.40
	Phosphoric acid,	2.58	3.02

Valuation in Neighboring States.

It is desirable from all points of view, that the schedules of valuation throughout a district in which similar market conditions prevail, should differ as little as possible. It has been our practice in the past, to conform our schedule to that adopted after very careful co-operative study of market conditions for each year, by the New England States and New Jersey, except where the peculiar conditions of our markets have made the valuations diverge too largely from the actual selling prices, as in the case of ground bone and dissolved rock phosphates. The schedules for these States for 1908 and 1909 are as follows:

Trade Values Adopted by the New England States and New Jersey.

	Cents per Pound.	Values in 1909 in per cent. of those in 1908.	
	1908.	1909.	
Nitrogen:			
In ammonia salts, -----	17 ¹	17	97.1
In nitrates, -----	19 ²	19 ²	99.2
In dry and fine ground fish, meat, blood and mixed fertilizers, -----	20 ³	19	98.7
In fine ground bone and tankage, -----	20 ³	19	98.7
In coarse bone and tankage, -----	15	14	98.3
Phosphoric acid:			
Water soluble, -----	5.0	4.0	80.0
Citrate soluble, -----	4 ⁴	3 ⁴	77.7
In fine bone and tankage, -----	4.0	3 ⁴	87.5
In coarse bone and tankage, -----	3.0	3.0	100.0
In mixed fertilizers, insoluble, -----	2.0	3.0	100.0
Potash:			
In forms free from muriate, -----	5.0	5.0	100.0
As muriate, -----	4 ⁴	4 ⁴	100.0

The changes for 1909 shown in this schedule show a close similarity to those exhibited by the New York wholesale quotations. The most striking exceptions are those for dried blood and ground bone. In each of these cases, the material forms part of a group for which a valuation is affixed in the schedules, and the price of the most largely sold have governed the rate affixed. It should always be remembered in considering the New England States schedules that current retail quotations are used to check the conclusions formed from the study of wholesale prices.

As in preceding years, the independent valuations of phosphoric acid from rock sources and of ground bone must be made. New York quotations show a drop of over 20 per cent. in the wholesale price of available phosphoric acid. During the period of September, 1908-February, 1909, as compared with September, 1907-February, 1908, the retail selling prices show some decrease, but not so markedly as the wholesale quotations. A proportional reduction of the scheduled pound-rate of valuation has therefore been made.

New England schedule classes bone with tankage just as is done in the Pennsylvania schedule. The schedule rate has been markedly decreased for the nitrogen in this class of materials. This change is fully justified by the wholesale quotations on tankage whereas the bone wholesale quotations show an increase rather than a decrease.

Inasmuch as the commercial samples of this class requiring valuation in Pennsylvania represent almost exclusively ground bone rather than tankage, and inasmuch also as the 1908 pound-rates give valuations materially below the average retail market price of ground bone sampled in the fall of 1908 during the present season, it has been deemed desirable to raise slightly the rate for nitrogen in fine and coarse bone and tankage.

Schedule of Values for Fertilizer Ingredients, 1909.

	Cents per Pound.
Nitrogen:	
In ammonia salts, -----	17
In nitrates, -----	16
In meat, dried blood and mixed fertilizers, -----	19
In fine ground bone and tankage, -----	16
In coarse bone and tankage, -----	14
Phosphoric acid:	
Soluble in water, in bone fertilizers, -----	4
Soluble in water, in rock fertilizers, -----	22
Soluble in ammonium citrate, in bone fertilizers, -----	28
Soluble in ammonium citrate, in rock fertilizers, -----	26
Insoluble in ammonium citrate, in bone fertilizers, -----	2
Insoluble in ammonium citrate, in rock fertilizers, -----	14
In fine bone, tankage and fish, -----	3
In coarse bone and tankage, -----	2½
In cottonseed meal, castor pomace and wood ashes, -----	4
Potash:	
In high grade sulphate or forms free from muriate, -----	5
As muriate, -----	4½

Potash in excess of that equivalent to the chlorin present, will be valued as sulphate, and the remainder as muriate.

In certain cases where specific claim is made by the manufacturer that potash has been added as carbonate, potash in excess of that equivalent to soluble chloride and soluble sulphates will be valued as carbonate.

Nitrogen in mixed fertilizers will be valued as derived from the best sources of organic nitrogen, unless clear evidence to the contrary is obtained.

Phosphoric acid in mixed fertilizers is valued at bone phosphoric acid prices, unless clearly found to be derived from rock phosphate.

Bone is sifted into two grades of fineness; Fine, less than 1-50 inch in diameter; coarse, over 1-50 inch in diameter.

The result obtained by the use of this schedule does not cover the items of mixing, bagging, freight and agents' commission. To cover these, allowances are made as follows:

For freight, an allowance of \$2.00 per ton on all fertilizers.

For bagging, allowance of \$1.00 per ton on all fertilizers, except when sold in original packages.

For mixing, an allowance of \$1.00 per ton on complete fertilizers and rock-and-potash goods.

For agents' commission, an allowance of 20 per cent. is added to the cash value of the goods ready for shipment.

FERTILIZER ANALYSES JANUARY 1, TO AUGUST 1, 1909.

Since January 1, 1909 there have been received from authorized sampling agents fifteen hundred and sixty-five fertilizer samples, of which six hundred and seventeen were subjected to analysis. Preference is given to those which have not been recently analyzed. In cases where two or more samples representing the same brand were received, equal portion from several samples were united, and the composite sample was subjected to analysis.

The samples analyzed group themselves as follows: 426 complete fertilizers, furnishing phosphoric acid, potash and nitrogen; 8 dissolved bones, furnishing phosphoric acid and nitrogen; rock-and-potash fertilizers, furnishing phosphoric acid and potash; 33 acidulated rock phosphates, furnishing phosphoric acid only; 24 ground bones, furnishing phosphoric acid and nitrogen, and fifteen miscellaneous samples, which group includes substances not properly classified under the foregoing heads.

The determinations to which a complete fertilizer is subjected are as follows: (1) Moisture, useful for the comparison of analyses, for indication of dry condition and fitness for drilling, and also of the conditions under which the fertilizer was kept in the warehouses. (2) Phosphoric acid—total, that portion soluble in water, and of the residue, that portion of soluble in warm ammonia citrate solution (a solution supposed to represent the action of plant roots upon the fertilizer), which is assumed to have little immediate food value. By difference, it is easy to compute the so-called "reverted" acid, which is the portion insoluble in water but soluble in the citrate. The sum of the soluble and reverted is commonly called the "available" phosphoric acid. (3) Potash soluble in water—most of that present in green sand marl and crushed minerals, and even some of that present in vegetable materials such as cotton-seed meal, not being included because insoluble in water even after long boiling. (4) Nitrogen—This element is determined by a method which simply accounts for all present, without distinguishing between the quantities present in the several forms of ammonium salts, nitrates or organic matter. (5) Chlorin—this determination is made to afford a basis for estimating the proportion of the potash that is present as chlorid or muriate, the cheaper source. The computation is made on the assumption that the chlorin present, unless in excess, has been introduced in the form of muriate of potash; but doubtless there are occasional exceptions to this rule. One part of chlorin combines with 1.326 parts of potash to form the pure muriate; knowing the chlorin, it is, therefore, easy to compute the potash equivalent thereto. (7) In the case of ground bone, the state of subdivision is determined by sifting through accurately made sieves; the

cost of preparation and especially the promptness of action of bone in the soil depends very largely on the fineness of its particles the finer being much more quickly useful to the plant.

The law having required the manufacturer to guarantee the amount of certain valuable ingredients present in any brand he may put upon the market, chemical analysis is employed to verify the guarantees stamped upon the fertilizer sacks. It has, therefore, been deemed desirable in this report to enter the guaranty filed by the manufacturer in the office of the Secretary of Agriculture, in such connection with the analytical results that the two may be compared. An unfortunate practice has grown up among manufacturers of so wording the guaranty that it seems to declare the presence in the goods of an amount of a valuable constituent ranging from a certain minimum to a much higher minimum; thus, "Potash, 2 to 4 per cent." is a guaranty not infrequently given. In reality, the sole guaranty is for 2 per cent. The guaranteed amounts given for each brand in the following tables, are copied from the guarantees filed by the maker of the goods with the Secretary of the Agriculture, the lowest figure given for any constituent being considered to be the amount guaranteed. For compactness and because no essentially important fact is suppressed thereby, the guarantees for soluble and reverted phosphoric acid have not been given separately, but are combined into a single guaranty for available phosphoric acid; in cases where the maker's guaranty does not specifically mention available phosphoric acid, the sum of the lowest figures given by him for soluble and reverted phosphoric acid is used. The law of 1879 allowed the maker to express his guaranty for nitrogen either in terms of that element or in terms of the ammonia equivalent thereto; since ammonia is composed of three parts of hydrogen and fourteen parts of nitrogen, it is a very simple matter to calculate the amount of one, when the amount of the other is given; the amount of nitrogen multiplied by 1.214 will give the corresponding amount of ammonia, and the amount of ammonia multiplied by 0.824 will give the corresponding amount of nitrogen. In these tables, the expression is in terms of nitrogen.

The law of 1901 abolishes this alternative and requires that the guaranty shall be given in terms of nitrogen. Many manufacturers after complying with the terms of the law, insert additional items in their guarantees, often with the result of misleading or confusing the buyer; the latter will do well to give heed to those items only that are given as the law requires and that the presented in these tables.

A summary of the analysis made this season may be presented as follows:

Summary of Analysis Made this Season.

	Complete fertilizers.	Rock and potash.	Dissolved bone.	Dissolved rock.	Ground bone.
Number of analyses,	426	111	8	38	24
Moisture, per cent.,	8.56	8.80	7.59	7.86	4.64
Phosphoric acid:					
Total, per cent.,	9.83	11.05	12.94	15.15	22.12
Soluble, per cent.,	4.81	5.68	6.46	8.97	-----
Reverted, per cent.,	3.26	4.86	4.38	4.98	-----
Insoluble, per cent.,	1.76	1.01	2.15	1.22	-----
Potash, per cent.,	5.07	4.00	-----	-----	-----
Nitrogen, per cent.,	1.67	-----	1.57	-----	8.22
Mechanical analyses of bone:					
Fine,	-----	-----	-----	-----	71
Coarse,	-----	-----	-----	-----	39
Commercial valuation,	25.41	15.94	21.57	18.68	30.26
Average selling price,	24.88	16.98	22.25	14.76	30.70
Commercial value of samples whose selling price is ascertained,	25.31	15.94	21.57	18.62	30.28

The cases of departure of goods from their guaranteed composition observed this season, including only those cases in which it amounted to two-tenths per cent. or more were as follows:

Summary of Instances of Deficiency From Guaranty.

	Complete fertilizers.	Rock and potash.	Dissolved bone.	Dissolved rock.	Ground bone.
Deficient in four constituents,	2	-----	-----	-----	-----
Deficient in three constituents,	11	2	-----	-----	-----
Deficient in two constituents,	47	5	2	8	-----
Deficient in one constituent,	108	88	-----	8	5
Total number of samples in which deficiencies occur,	188	40	2	11	5

The cases of deficiency noted during the past ten seasons in goods as compared with their guaranties expressed in percentage of the total number of goods each class analyzed, are as follows:

Percentage of Deficiency 1903-1909.

	Spring, 1903.	Fall, 1903.	Spring, 1904.	Fall, 1904.	Spring, 1905.	Fall, 1905.	Spring, 1906.	Fall, 1906.	Spring, 1907.	Fall, 1907.	Spring, 1908.	Fall, 1908.	Spring, 1909.
Complete fertilizers	37.5	27.9	39.5	49.2	35.8	37.5	45.4	39.5	30.4	39.3	40.0	40.0	39.5
Dissolved bone	33.8	63.6	•	50.0	100.0	66.6	50.0	28.5	16.6	25.0	150.0	16.6	25.0
Rock and potash	22.9	43.2	50.7	35.8	30.9	32.0	42.4	40.0	42.7	49.0	39.0	38.3	35.2
Dissolved rock	23.2	20.0	20.0	11.1	9.8	10.0	28.8	25.6	19.5	27.0	21.2	22.5	33.8
Ground bone	33.8	—	36.8	36.8	40.0	31.4	49.0	14.7	18.5	27.8	38.0	40.0	30.8
All classes except miscellaneous	36.1	44.7	39.6	41.4	32.8	31.4	43.8	36.8	36.1	38.9	38.8	38.8	37.6

*Only two samples analyzed for which no guarantees are reported.

†Only two samples analyzed for which guarantees are recorded.

!Only four samples analyzed.

A comparison of the average composition of all sample of complete fertilizers for which guarantees are recorded with the average of the corresponding guarantees, for several seasons past including those of this season, follows:

Average Composition and Guaranty Compared.

	Spring, 1903.	Average composition. Per cent.	Average guaranty. Per cent.
Phosphoric acid:			
Total,	11.90	10.67	
Available,	9.86	8.73	
Potash,	3.85	3.03	
Nitrogen,	1.58	1.61	
	Fall, 1903.		
Phosphoric acid:			
Total,	10.76	9.66	
Available,	8.84	8.13	
Potash,	4.09	3.90	
Nitrogen,	1.83	1.29	
	Spring, 1904.		
Phosphoric acid:			
Total,	10.34	9.32	
Available,	8.27	7.37	
Potash,	4.00	3.80	
Nitrogen,	1.58	1.55	
	Fall, 1904.		
Phosphoric acid:			
Total,	10.49	9.73	
Available,	8.50	7.70	
Potash,	2.87	2.61	
Nitrogen,	1.25	1.29	
	Spring, 1906.		
Phosphoric acid:			
Total,	10.16	9.43	
Available,	8.50	7.92	
Potash,	4.45	4.22	
Nitrogen,	1.61	1.58	

Average Composition and Guaranty Compared—Continued.

	Average composition. Per cent.	Average guaranty. Per cent.
Fall, 1905.		
Phosphoric acid:		
Total,	10.68	9.62
Available,	8.72	8.13
Potash,	2.90	2.48
Nitrogen,	1.26	1.20
Spring, 1906.		
Phosphoric acid:		
Total,	9.78	9.21
Available,	7.88	7.77
Potash,	4.21	3.95
Nitrogen,	1.57	1.58
Fall, 1906.		
Phosphoric acid:		
Total,	10.45	9.70
Available,	8.28	8.16
Potash,	3.18	2.96
Nitrogen,	1.32	1.31
Spring, 1907.		
Phosphoric acid:		
Total,	9.21	8.50
Available,	8.13	7.88
Potash,	4.55	4.31
Nitrogen,	1.52	1.47
Fall, 1907.		
Phosphoric acid:		
Total,	10.39	9.42
Available,	8.34	8.07
Potash,	3.18	2.72
Nitrogen,	1.39	1.29
Spring, 1908.		
Phosphoric acid:		
Total,	10.07	8.91
Available,	8.29	7.61
Potash,	5.04	4.51
Nitrogen,	1.64	1.50
Fall, 1908.		
Phosphoric acid:		
Total,	10.29	9.31
Available,	8.29	7.96
Potash,	3.24	2.94
Nitrogen,	1.24	1.23
Spring, 1909.		
Phosphoric acid:		
Total,	9.83	8.98
Available,	8.07	7.66
Potash,	5.07	4.89
Nitrogen,	1.07	1.00

It is of interest to note how closely the series of valuations based upon the wholesale price of raw materials in the principal markets during the most important buying season and upon certain average allowances for expenses and profits on the part of the mixer and jobber, coincides with the retail prices later ascertained. A comparison for several seasons past is given below:

Comparison of Selling Price and Valuation, 1902-1909.

	Selling price.	Valuation.	Excess of valuation over selling price.
Complete fertilizers:			
1902, Spring,	24.10	25.33	1.23
Fall,	21.83	23.31	1.48
1903, Spring,	24.57	24.15	-.42
Fall,	21.98	22.77	.79
1904, Spring,	24.28	24.99	.71
Fall,	21.82	22.53	.71
1905, Spring,	24.63	25.60	.97
Fall,	21.39	22.35	.96
1906, Spring,	23.55	24.76	1.21
Fall,	21.87	23.99	1.12
1907, Spring,	24.00	26.84	2.24
Fall,	22.71	24.59	1.88
1908, Spring,	25.69	26.23	-.54
Fall,	22.84	23.88	1.54
1909, Spring,	24.88	25.31	.43
Dissolved bone:			
1902, Spring,	16.80	17.85	.26
Fall,	25.30	27.08	1.78
1903, Spring,	21.17	20.87	-.30
Fall,	23.67	24.57	.90
1904, Spring,	31.50	28.42	-.83
Fall,	24.94	27.77	2.83
1905, Spring,	28.88	28.70	-.18
Fall,	24.78	25.86	1.11
1906, Spring,	24.40	22.65	-.75
Fall,	23.06	25.33	2.27
1907, Spring,	22.28	25.08	2.80
Fall,	22.09	27.01	4.92
1908, Spring,	21.11	28.09	1.98
Fall,	22.48	26.05	3.57
1909, Spring,	22.26	21.57	-.69
Rock and potash:			
1902, Spring,	16.45	15.05	-1.40
Fall,	15.97	14.46	-1.51
1903, Spring,	17.20	14.74	-2.46
Fall,	15.96	14.86	-1.10
1904, Spring,	16.47	15.45	-1.01
Fall,	15.80	14.98	.97
1905, Spring,	16.11	15.49	-.62
Fall,	15.97	15.04	-.97
1906, Spring,	16.17	15.19	-.98
Fall,	15.76	15.06	-.70
1907, Spring,	16.94	16.58	-.41
Fall,	16.58	15.98	-.76
1908, Spring,	16.86	16.24	-.62
Fall,	16.48	16.17	-.36
1909, Spring,	16.98	15.94	-1.04
Dissolved rock:			
1902, Spring,	18.78	18.49	-.24
Fall,	18.54	18.70	.12
1903, Spring,	15.18	18.34	-1.79
Fall,	14.64	13.13	-1.50
1904, Spring,	14.59	14.05	-.54
Fall,	13.89	14.09	.20
1905, Spring,	18.64	18.86	.22
Fall,	12.21	13.51	1.30
1906, Spring,	18.75	18.98	.27
Fall,	13.45	13.90	.46
1907, Spring,	14.04	14.72	.68
Fall,	14.18	14.87	.51
1908, Spring,	14.73	14.92	.20
Fall,	14.31	14.86	.55
1909, Spring,	14.76	15.03	-1.14

Comparison of Selling Price and Valuation, 1902-1909—Continued.

	Selling price.	Valuation.	Excess of valuation over selling price.
Ground bone:			
1902, Spring,	28.53	26.80	-1.73
Fall,	28.09	27.51	-.58
1903, Spring,	28.67	27.25	-1.42
Fall,	27.53	27.07	-.45
1904, Spring,	28.20	27.70	-.50
Fall,	27.03	27.97	.95
1905, Spring,	29.06	26.73	-2.33
Fall,	27.70	28.70	1.00
1906, Spring,	29.08	28.28	-.79
Fall,	27.80	29.12	1.32
1907, Spring,	31.55	29.64	-1.91
Fall,	28.92	28.80	-.12
1908, Spring,	29.04	28.96	-.08
Fall,	28.18	27.90	-.28
1909, Spring,	30.70	30.23	-.42

FERTILIZER ANALYSES AUGUST 1, TO DECEMBER 31, 1909.

Since August 1, 1909, there have been received from authorized sampling agents twelve hundred and twenty-two fertilizer samples, of which four hundred and thirty-six were subjected to analysis. Preference is given to those which have not been recently analyzed. In cases where two or more samples representing the same brand were received, equal portion from several samples were united, and the composite sample was subjected to analysis.

The samples analyzed group themselves as follows: 255 complete fertilizers, furnishing phosphoric acid, potash and nitrogen; 3 dissolved bones, furnishing phosphoric acid and nitrogen; 92 rock-and-potash fertilizers, furnishing phosphoric acid and potash; 41 acidulated rock phosphates, furnishing phosphoric acid only; 26 ground bones, furnishing phosphoric acid and nitrogen, and 19 miscellaneous samples, which group includes substances not properly classified under the foregoing heads.

The determinations to which a complete fertilizer is subjected are as follows: (1) Moisture, useful for the comparison of analyses, for indication of dry condition and fitness for drilling, and also of the conditions under which the fertilizer was kept in the warehouse. (2) Phosphoric acid—total, that portion soluble in water, and of the residue, that portion not soluble in warm ammonia citrate solution (a solution supposed to represent the action of plant roots upon the fertilizer), which is assumed to have little immediate food value. By difference, it is easy to compute the so-called "reverted" acid which is the portion insoluble in water but soluble in the citrate. The sum of the soluble and reverted is commonly called the "available" phosphoric acid. (3) Potash soluble in water—most of that present in green sand marl and crushed minerals, and even some of that present in vegetable materials such as cotton-seed meal, not being included because insoluble in water even after long boiling.

(4) Nitrogen—This element is determined by a method which simply accounts for all present, without distinguishing between the quantities present in the several forms of ammonium salts, nitrates or organic matter. (5) Chlorin—this determination is made to afford a basis for estimating the proportion of the potash that is present as chlorid or muriate, the cheaper source. The computation is made on the assumption that the chlorin present, unless in excess, has been introduced in the form of muriate of potash; but doubtless there are occasional exceptions to this rule. One part of chlorin combines with 1.326 parts of potash to form the pure muriate; knowing the chlorin, it is, therefore, easy to compute the potash equivalent thereto. (7) In the case of ground bone, the state of sub-division is determined by sifting through accurately made sieves; the cost of preparation and especially the promptness of action of bone in the soil depends very largely on the fineness of its particles the finer being much more quickly useful to the plant.

The law having required the manufacturer to guarantee the amount of certain valuable ingredients present in any brand he may put upon the market, chemical analysis is employed to verify the guarantees stamped upon the fertilizer sacks. It has, therefore, been deemed desirable in this report to enter the guaranty filed by the manufacturer in the office of the Secretary of Agriculture, in such connection with the analytical results that the two may be compared. An unfortunate practice has grown up among manufacturers of so wording the guaranty that it seems to declare the presence in the goods of an amount of a valuable constituent ranging from a certain minimum to a much higher maximum; thus, "Potash, 2 to 4 per cent." is a guaranty not infrequently given. In reality, the sole guaranty is for 2 per cent. The guaranteed amounts given for each brand in the following tables, are copied from the guarantees filed by the maker of the goods with the Secretary of Agriculture the lowest figure given for any constituent being considered to be the amount guaranteed. For compactness and because no essentially important fact is suppressed thereby, the guarantees for soluble and reverted phosphoric acid have not been given separately, but are combined into a single guaranty for available phosphoric acid; in cases where the maker's guaranty does not specifically mention available phosphoric acid, the sum of the lowest figures given by him for soluble and reverted phosphoric acid is used. The law of 1879 allowed the maker to express his guaranty for nitrogen either in terms of that element or in terms of the ammonia equivalent thereto; since ammonia is nitrogen. In these tables, the expression is in terms of nitrogen.

The law of 1909 abolishes this alternative and requires that the guaranty shall be given in terms of nitrogen. Many manufacturers after complying with the terms of the law, insert additional items in their guarantees, often with the result of misleading or confusing the buyer; the latter will do well to give heed to those items only that are given as the law requires and that are presented in these tables.

"For the purpose of indicating more specifically to the eye, cases deficient in guarantee, an asterisk has been affixed where the ingredient has been found less in quantity than the manufacturer guaranteed. Too great emphasis should not be placed upon very slight deficiencies, because very slight imperfections in mixing and slight variations in

analysis are practically unavoidable. The asterisk has been used, therefore, only in cases where the deficiencies amount to 0.2 per cent. or more, except where nitrogen has been guaranteed in amounts not higher than 1.0 per cent. in which case an asterisk has been affixed where the deficiency amounts to 0.1 per cent. or more."

A summary of the analyses made this season may be presented as follows:

Summary of Analyses Made this season.

	Complete fertilizers.	Rock and potash.	Dissolved bone.	Dissolved rock.	Ground bone.
Number of analyses,	256	93	3	41	26
Moisture, per cent.,	8.54	8.58	8.24	7.78	4.65
Phosphoric acid:					
Total, per cent.,	10.17	11.06	13.05	15.38	22.23
Soluble, per cent.,	4.78	5.76	6.25	10.35	.....
Reverted, per cent.,	3.52	4.30	4.56	3.86	.....
Insoluble, per cent.,	1.87	1.00	2.25	1.17	.....
Potaash, per cent.,	3.41	8.55	.....	.....	.....
Nitrogen, per cent.,	1.88	.....	1.93	.....	2.87
Mechanical analyses of bone:					
Fine, .....	.....	.....	.....	.....	62
Coarse, .....	.....	.....	.....	.....	38
Commercial valuation,	22.22	15.47	22.85	14.02	28.67
Average selling price,	22.07	16.10	24.50	18.86	29.39
Commercial value of samples whose selling price is ascertained,	22.21	15.50	22.85	14.02	28.71

The cases of departure of goods from their guaranteed composition observed this season, including only those cases in which it amounted to two-tenths per cent. or more, were as follows:

Summary of Instances of Deficiency from Guaranty.

	Complete fertilizers.	Rock and potash.	Dissolved bone.	Dissolved rock.	Ground bone.
Deficient in four constituents,	0	.....	.....	.....	.....
Deficient in three constituents,	2	2	.....	.....	.....
Deficient in two constituents,	28	5	1	1	.....
Deficient in one constituent,	71	21	1	7	.....
Total number of samples in which defi- ciencies occur,	119	28	2	8	10

The cases of deficiency noted during the past ten seasons in goods as compared with their guaranties expressed in percentage of the total number of goods of each class analyzed, are as follows:

Percentage of Deficiency 1903-1909

				Fall, 1909.
				Sprng. 1909.
				Fall, 1908.
				Sprng. 1908.
				Fall, 1907.
				Sprng. 1907.
				Fall, 1906.
				Sprng. 1906.
				Fall, 1905.
				Sprng. 1905.
				Fall, 1904.
				Sprng. 1904.
				Fall, 1903.
				Sprng. 1903.
Complete fertilizers,	37.5	37.0	39.5	40.2
Dissolved bone,	33.3	33.0	30.7	50.0
Rock and potash,	22.9	43.2	20.0	35.3
Dissolved rock,	22.9	20.0	20.0	11.1
Ground bone,	38.3	36.3	36.3	40.0
All classes except miscellaneous,	85.1	44.7	30.6	41.4

*Only two samples analyzed for which no guarantees are reported.

†Only two samples analyzed for which guarantees are recorded.

;Only four samples analyzed.

A comparison of the average composition of all samples of complete fertilizers for which guaranties are recorded with the average of the corresponding guaranties, for several seasons past including those of this season, follows:

Average Composition and Guaranty Compared.

	Average composition. Per cent.	Average guaranty. Per cent.
Spring, 1908.		
Phosphoric acid:		
Total, -----	11.90	10.67
Available, -----	9.35	8.73
Potash, -----	3.85	3.68
Nitrogen, -----	1.56	1.61
Fall, 1908.		
Phosphoric acid:		
Total, -----	10.76	9.66
Available, -----	8.84	8.18
Potash, -----	4.06	3.90
Nitrogen, -----	1.83	1.29
Spring, 1904.		
Phosphoric acid:		
Total, -----	10.24	9.82
Available, -----	8.37	7.87
Potash, -----	4.09	3.90
Nitrogen, -----	1.56	1.55
Fall, 1904.		
Phosphoric acid:		
Total, -----	10.49	9.72
Available, -----	8.50	7.70
Potash, -----	2.87	2.61
Nitrogen, -----	1.25	1.29
Spring, 1905.		
Phosphoric acid:		
Total, -----	10.16	9.42
Available, -----	8.50	7.92
Potash, -----	4.55	4.22
Nitrogen, -----	1.61	1.58
Fall, 1905.		
Phosphoric acid:		
Total, -----	10.63	9.62
Available, -----	8.72	8.18
Potash, -----	2.90	2.42
Nitrogen, -----	1.36	1.30
Spring, 1906.		
Phosphoric acid:		
Total, -----	9.73	8.21
Available, -----	7.88	7.77
Potash, -----	4.21	3.95
Nitrogen, -----	1.57	1.58
Fall, 1906.		
Phosphoric acid:		
Total, -----	10.45	9.70
Available, -----	8.23	8.16
Potash, -----	3.12	2.96
Nitrogen, -----	1.33	1.31
Spring, 1907.		
Phosphoric acid:		
Total, -----	9.21	8.60
Available, -----	8.18	7.88
Potash, -----	4.55	4.31
Nitrogen, -----	1.56	1.47

Average Composition and Guaranty Compared—Continued.

	Average composition. Per cent.	Average guaranty. Per cent.
Fall, 1907.		
Phosphoric acid:		
Total,	10.39	9.42
Available,	8.34	8.07
Potash,	3.18	2.72
Nitrogen,	1.39	1.29
Spring, 1908.		
Phosphoric acid:		
Total,	10.07	8.91
Available,	8.29	7.61
Potash,	5.04	4.51
Nitrogen,	1.64	1.50
Fall, 1908.		
Phosphoric acid:		
Total,	10.29	9.81
Available,	8.29	7.96
Potash,	3.34	2.91
Nitrogen,	1.24	1.23
Spring, 1909.		
Phosphoric acid:		
Total,	9.88	8.93
Available,	8.07	7.63
Potash,	5.07	4.83
Nitrogen,	1.67	1.60
Fall, 1909.		
Phosphoric acid:		
Total,	10.18	9.31
Available,	8.27	8.08
Potash,	3.41	3.12
Nitrogen,	1.88	1.26

It is of interest to note how closely the series of valuations base upon the wholesale price of raw materials in the principal markets during the most important buying season and upon certain average allowances for expense and profits on the part of the mixer and jobber coincides with the retail prices later ascertained. A comparison for several seasons past is given below:

Comparisons of Selling Price and Valuation, 1902-1909.

	Selling price.	Valuation.	Excess of valuation over selling price.
Complete fertilizers:			
1902, Spring,	24.10	25.33	1.25
Fall,	21.88	23.31	1.48
1903, Spring,	24.57	24.15	-.42
Fall,	21.98	22.77	.79
1904, Spring,	24.28	24.99	.71
Fall,	21.82	22.53	.71
1905, Spring,	24.68	25.60	.97
Fall,	21.89	22.85	.96
1906, Spring,	23.55	24.76	1.21
Fall,	21.87	22.99	1.12
1907, Spring,	24.60	26.84	2.24
Fall,	22.71	24.59	1.88
1908, Spring,	25.69	26.23	.54
Fall,	22.34	23.88	1.54
1909, Spring,	24.88	25.31	.43
Fall,	22.07	22.25	.14
Dissolved bone:			
1902, Spring,	16.50	17.35	.85
Fall,	25.30	27.08	1.78
1903, Spring,	31.17	30.87	-.30
Fall,	28.67	24.57	.90
1904, Spring,	31.50	28.42	-3.08
Fall,	24.94	27.77	2.83
1905, Spring,	28.83	22.70	-1.13
Fall,	24.78	25.85	1.11
1906, Spring,	24.40	22.65	-1.75
Fall,	22.06	25.33	3.27
1907, Spring,	22.28	25.06	2.80
Fall,	22.09	27.01	4.92
1908, Spring,	21.11	23.09	1.98
Fall,	22.48	26.05	3.97
1909, Spring,	22.25	21.57	-.68
Fall,	24.50	22.85	-1.65
Rock and Potash:			
1902, Spring,	16.45	15.05	-1.40
Fall,	15.97	14.46	-1.51
1903, Spring,	17.20	14.74	-2.46
Fall,	15.96	14.86	-1.10
1904, Spring,	16.47	15.46	-1.01
Fall,	15.89	14.92	-.97
1905, Spring,	16.11	15.49	-.62
Fall,	15.97	15.04	-.97
1906, Spring,	16.17	15.19	-.98
Fall,	15.76	15.06	-.70
1907, Spring,	16.94	16.53	-.41
Fall,	16.58	15.82	-.76
1908, Spring,	16.86	16.24	-.62
Fall,	16.43	16.17	-.26
1909, Spring,	16.98	15.94	1.04
Fall,	16.10	15.50	-.60
Dissolved rock:			
1902, Spring,	18.73	18.49	-.24
Fall,	13.54	13.70	.12
1903, Spring,	15.13	18.84	-1.79
Fall,	14.64	13.12	-1.52
1904, Spring,	14.59	14.05	-.54
Fall,	13.89	14.09	.20
1905, Spring,	13.64	13.86	.22
Fall,	12.21	13.51	1.30
1906, Spring,	13.75	12.98	-.77
Fall,	13.45	12.99	-.46
1907, Spring,	14.04	14.72	.68
Fall,	14.16	14.67	.51
1908, Spring,	14.72	14.92	.20
Fall,	14.81	14.88	.55
1909, Spring,	14.76	14.62	-.14
Fall,	13.86	14.02	.16

Comparison of Selling Price and Valuation, 1902-1909—Continued.

	Selling price.	Valuation.	Excess or valuation over selling price.
Ground bone:			
1902, Spring,	26.62	26.80	-1.72
Fall,	28.09	27.51	-1.53
1903, Spring,	28.67	27.25	-1.42
Fall,	27.53	27.07	-45
1904, Spring,	28.20	27.70	-50
Fall,	27.02	27.97	.95
1905, Spring,	29.08	28.72	-2.35
Fall,	27.70	28.70	1.00
1906, Spring,	29.02	28.23	-79
Fall,	27.80	29.12	1.32
1907, Spring,	31.55	29.64	-1.91
Fall,	28.92	28.80	-12
1908, Spring,	29.04	28.96	-.08
Fall,	28.18	27.90	-1.28
1909, Spring,	30.70	30.28	-42
Fall,	29.89	28.71	-68

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INDEX BY AUTHORS.

	Page.
A	
AGEE, PROF. ALVA, Alfalfa in Pennsylvania,	374
Four essentials of soil fertility,	534
ARMSBY, DR. H. P., The pure bred versus the scrub steer,	627
ATWATER, C. S., Sulphate ammonia,	525
ARNY, L. W., Market gardening on the farm of the late R. F. Schwarz,	695
B	
BARTLEY, N. F., Past, present and future of agriculture,	498
BASSETT, C. E., Getting together,	598
Practical principles for profitable production,	623
BAYARD, E. S., Breeding beef cattle,	408
BEAVER, JUDGE, An address,	505
BITTINGER, HON. J. W., Address of welcome, Normal Institute,	334
BOYER, JOHN F., Experience with peaches,	664
BRIGGS, J. S., Life habits and history of the brown tail moth,	667
BUCKHOUT, PROF. W. A., Report of Botanist,	479
BURNS, J. S., Starting a flock of sheep,	404
C	
COCHEL, PROF. W. A., Animal husbandry in Pennsylvania,	577
Demonstration of beef cattle,	736
COLLINGWOOD, H. W., The man and woman crop,	369
CONARD, DR. M. E., Care of milk,	379
CONKLIN, ROBERT, Report on forests and forestry,	573
COOKE, PROF. WELLS W., The indigestible part of the ration of the dairy cow,	414
CORNMAN, CHARLES F., Poultry light for those who sit in darkness,	387
CRITCHFIELD, HON. N. B., (Secretary of Agriculture):	
Report of,	3
Agricultural and climatic conditions of crops,	3
Main crops of the State,	4
Number of farm animals, end of 1909,	6
Comparison of crops produced with feed required by the animals of the State,	7
Feeding requirements,	7
Dairying and growing crops for the dairy,	8
Crop rotation,	9
The silo,	10
Systems of farming,	10
Animals and the high cost of living,	11
Soil fertility,	12
Reports of Divisions of Department,	15
Fertilizer control,	19
Agricultural Associations of the State,	22
State fair,	25
D	
DARLINGTON, M. P., Creamery construction,	732
DORSETT, E. B., The American farmer, his past, present and future,	516
DOTY, S. W., Carcass demonstration,	753
E	
ELKINS, ROBERT, The cost of milk production and maintenance of herds for purchase,	722
(795)	

F

	Page.
FOUST, JAMES, (Dairy and Food Commissioner):	
Report of,	84
Unification of State and Federal laws,	85
Action of the legislature of 1909,	86
A year of activity,	90
The sale of oleomargarine,	91
Oleo versus real butter,	94
The bane of dairymen,	96
Results of prosecutions,	96
An important case,	98
Value of trade journals,	99
Summary of articles analyzed,	104
Cases terminated,	110
Financial statement,	110
The new food law,	111
Court records relative to constitutionality of food law,	117
FREAR, DR. WILLIAM, Report of Chemist,	482
FUNK, DR. J. H., Commercial orcharding,	352

G

GARDNER, PROF. F. D., Corn improvement by selection, breeding and testing,	444
How to improve our corn,	744
GIBSON, H. NOEL, Sheep demonstration,	742
GILLILAND, DR. S. H. (State Veterinarian):	
Report of,	142
Work of meat hygiene,	143
Inspection of diseases,	147
Tuberculous cattle,	150
Glanders,	154
Rabies,	155
Anthrax,	158
Black leg,	158
Mange,	159
Hog cholera,	161
Texas fever,	162
Miscellaneous diseases,	163
Horse-breeding,	164
Report of the laboratory of milk hygiene,	166
Report of bacterial laboratory,	166
Report of experiment farm for study of diseases of domestic animals,	176
Report of outbreak of aphthous fever found in Pennsylvania, 1908-1909,	181
GOODERHAM, H. M., Report of Committee on Poultry,	543
GOULD, H. P., Apple varieties; old ones that are good and new ones that seem promising,	674

H

HALBERSTADT, PROF. BAIRD, (Mineralogist):	
The principal limestone deposits of Pennsylvania and their adaptability to the manufacture of Portland Cement,	545
HAMILTON, PROF. JOHN, An address,	503
HARBISON, MR., An address,	717
HARVEY, DR. ISAAC, Report of Geologist,	563
HERR, JOHN D., Report of General Fruit Committee,	627
HERSHEY, H. F., Some Western apple methods,	634
HIESTER, GABRIEL, Report of Pomologist,	500
HULL, D. W., Celery culture,	701
HUNT, DR. THOMAS F., Improvement of meadows and pastures,	489
HUTCHISON, G. G., Report of Committee on Feeding Stuffs,	465

J

JACKSON, HOMER W., Poultry keeping on the farm,	383
--	-----

K

KING, D. WARD, The split road drag and its use for the dirt roads in Pennsylvania,	427
KLINGER, H. C., Report of Apiarist,	561
KNUPPENBURG, D. A., Report of Committee on Fruits and Fruit Culture,	507

L

	Page.
LEE, D. W., Choosing a vocation and what comes of it,	575
LIGHTY, L. W., Twenty years experience in corn growing and breeding,	450
LYMAN, PROF. THOS B., Spraying for San José Scale,	619

M

MAIRS, PROF. THOS. I., Horse-breeding for Pennsylvania farmers,	422
MARTIN, HON. A. L. (Deputy Secretary and Director of Farmers' Institutes):	
Report of,	29
Crop report,	29
Summary,	28
Attendance at Institutes,	29
Program Normal Institute,	35
List of Institute Managers,	39
List of Institute Lecturers,	40
Lecturers and Schedule of dates,	41
Biography of Lecturers,	53
Crop report,	67
Agricultural Societies,	76
Response to address of welcome, Normal Institute,	337
McGOWAN, H. G., Report on legislation,	530
MENGES, PROF. FRANKLIN, Soil conservation or nature's methods, of maintaining soil fertility,	342
MOORE, DR. H. D., Report of Sanitarian,	486
MYERS, PROF. C. E., Experiments with cabbage and tomatoes,	703

P

PEACHEY, J. H., Alfalfa; how to grow it successfully,	376
PENNY, PROF. CHARLES L., Miscible oils,	363

R

RABILD, HELMER, Cow Testing Associations,	726
REPP, ALBERT T., Essential elements of success in fruit growing,	597

S

SCHIER, OSCAR V., Vital problems before the milk dealer,	709
SCHWARZ, R. F., Market gardening and small fruit growing for a profit,	439
SHAW, PROF. CHARLES F., Soil moisture,	348
SHOEMAKER, M. P., Report of Committee on Livestock,	527
SMITH, DR. R. A., Peaches,	672
SMYTHE, R. A., Cover crops,	658
STEWART, PROF. J. P., Orchard fertilization,	582
The making and use of concentrated lime-sulphur,	645
STOUT, W. H., Report of Geologist,	570
From a County Chairman's viewpoint,	426
STUART, GOV. EDWIN S., An address,	497
SURFACE, PROF. H. A. (Economic Zoologist):	
Report of,	248
Examining specimens and answering questions,	248
Investigations and experiments,	249
Effect of plant stimulant,	250
Experiments,	251
Publications,	252
Lectures and addresses,	254
Inspections,	254
Inspection of nurseries,	254
List of nurseries,	257
Licensed tree dealers,	263
Inspection of private nurseries,	265
Reports of inspection by counties,	268
Reports of orchard inspectors,	292
Inspection of imported plants and seeds,	322
Making collections,	323
Demonstration orchards,	324
Demonstration trains,	32b
Plans for the future,	327
Needs of the Bureau,	328
Report of Ornithologist,	537
Recent developments in the chemical study of lime-sulphur wash,	661

T

	Page.
TAYLOR, D. S., Report of Committee on Wool and Textile Fibres,	478
THORPE, DR. FRANCIS NEWTON, Grape culture,	639

V

VAN NORMAN, PROF. H. E., Address,	708
An address,	718
VINCENT, PROF. C. C., Practical demonstrations in the boxing of apples,	614

W

WAITE, PROF. M. B., Some new spraying mixtures and their value as fungicides,	683
WATTS, PROF. R. L., Soil improvement for market gardening and small fruit growing,	433
Orcharding in Pennsylvania,	556
Inter-cropping of young orchards with special reference to Adams County,	606
Asparagus culture,	691
WELLER, JOHN C., Report of Committee on Roads and Road Making,	509
WHETZEL, PROF. H. H., Some experiments with commercial lime-sulphur as a spray for fruit diseases,	611
WING, JOSEPH E., Alfalfa,	380
An address,	396
Profitable sheep farming,	399
WITTMAN, W. THEO., Poultry home construction,	394
WOLFF, WM. H., Some common orchard and garden insects; how to control them,	452
WOOLMAN, MR. Junior, An address,	714
WOOLMAN, MR. Senior, An address,	716
WRIGHT, PROF. W. J., Discussion of various nursery methods of propagation for best orchard results,	602

Y

YOUNG, A. P., Report of Committee on Cereals and Cereal Crops.	462
---	-----

INDEX BY SUBJECTS.

A		Page.
Addresses:		
Address of welcome, Normal Institute, Judge Bittinger,		334
Address, response, Hon. A. L. Martin,		337
Address, J. E. Wing,		396
Address, Governor Stuart,		499
Address, Prof. John Hamilton,		503
Address, Judge Beaver,		505
Address, Prof. H. E. Van Norman,		708
Address, Mr. Woolman, Junior,		714
Address, Mr. Woolman, Senior,		716
Address, Mr. Harbison,		717
Address, Prof. Van Norman,		718
Agriculture, report of Secretary,		3
Agricultural conditions of crops,		3
Main crops of the State,		4
Number of farm animals end of 1909,		6
Comparison of crops produced with feed required,		7
Feeding requirements,		7
Dairying and raising cattle for dairy,		8
Crop rotation for dairymen,		9
The silo,		10
Systems of farming,		10
Animals and high cost of living,		11
Soil fertility,		12
Crops adapted to soils,		14
Reports of Divisions of the Department,		15
Agricultural Societies of the State,		22
State Fair,		25
The man and woman crop,		369
The future of,		370
The children on the farm,		371
Past, present and future of,		498
Agricultural Department, publications of,		761
Agricultural Societies, dates of fairs,		76
Alfalfa in Pennsylvania,		374
How to grow it successfully,		376
Should study the plat,		376
Seed and seeding,		377
Culture of,		378
Story about,		381
Animal husbandry in Pennsylvania,		577
Meat animals,		577
Production of beef,		578
Feeding cattle,		579
Apiarist, report of,		561
Production of honey,		561
Bee diseases,		562
Appendix,		760
Apples, practical demonstration in boxing of,		614
When to pick,		615
Orchard boxes,		615
Packing houses,		616
Details of packing,		617
Styles of packs,		617
Some Western methods,		634
Oregon methods,		635
Pests and spraying,		637
Yields of,		637
Varieties of old ones and new,		674
Old varieties that are good,		677
New sorts that seem promising,		681

	Page.
Asparagus, culture of,	691
Soil for,	692
Selection of seed,	693
Preparation of ground,	693
The planting,	693
Time to apply fertilizer,	694

B

Bees, report of Apiarist,	561
Production of honey,	561
Diseases of,	562
Beef cattle, breeding of,	408
The man and the farm,	409
The breed,	410
The herd,	410
The sire,	411
Feeding of bulls and cows,	412
Barns for,	412
Feeding of,	413
Kind of steers to feed,	413
Demonstration of,	736
Botanist, report of,	479

C

Cabbage, experiments with,	703
The seed,	704
Varieties of,	705
Carcass demonstration,	753
Cattle, pure bred versus the scrub steer,	521
The problem of food supply,	521
Problem of stock feed,	522
Percentage of digestible feed,	523
Celery, culture of,	701
Cements, adaptability of limestones to,	545
Limestones for,	549
Types of,	553
Cereals, report of Committee on,	462
Corn,	462
Wheat,	464
Oats,	464
Chemistry, report of Chief of Bureau,	330
Chemist, report of,	482
Relation of fertilizers to root development,	482
Studies on fertilizers upon root development,	483
Corn improvement by selection, breeding and testing,	444
Securing the seed,	444
Selecting the seed,	445
Vitality of test,	445
Preparation for planting,	446
The breeding plot,	448
Growing and breeding of,	450
How we can improve our corn,	732
Cover crops, value of,	658
Value of vetch,	659
Cow Testing Associations,	726
History of in Denmark,	726
Success of such associations,	728
What the association is,	729
Methods of testing,	730
Creamery construction,	732
Stability of,	732
Dimensions of,	733
Machinery,	734

D

Dairy and Food Bureau, report of Commissioner,	84
Uniformity of Federal and State laws recommended,	85
Action of the Legislature of 1909,	86
A year of activity,	90
The sale of oleo,	91
General improvement in conditions,	93
Oleo versus real butter,	94
Comparative statement,	95

	Page.
The bane of the dairyman,	96
Results of prosecutions,	96
Value of trade journals,	99
Summary of articles analyzed,	104
Cases terminated,	110
Financial statement,	110
The new food law,	111
Court records,	117
Dairy cow, indigestible part of ration for,	414
Standards of feed,	415
Varieties of feed,	416
How much to feed,	417
Feeds that produce milk,	418
Analyses of feeds,	419
Standard rations,	420
E	
Entomologist, report of,	513
Spraying and its effects,	513
Conditions of plants,	515
F	
Farming, choosing a vocation,	575
Farmer, the American,	516
Of the past,	516
Of the present,	518
Of the future,	519
Farmers' Institutes, report of Director,	27
Attendance at,	29
Program Normal Institute,	30
List of County Chairmen,	39
List of State Lecturers,	40
Lecturers and dates of institutes,	41
Biographical sketches,	53
Addresses delivered at Normal Institute,	324
From a County Chairman's viewpoint,	426
Feeding stuffs, report on,	465
The new law,	466
By-products,	466
Tabulated statement,	468
Samples for individual analyses,	472
Improvement in feeds,	476
Fertilizers, importance of sulphate of ammonia,	525
Potential force of coal mines,	526
Value of for 1909,	766
Valuation in neighboring states,	773
Analyses of samples January 1 to August 1, 1909,	775
Summary of analyses made,	777
Average composition and guaranty compared,	778
Comparison selling price and valuations, 1902-1909,	779
Analyses of samples, August 1 to December 31, 1909,	781
Forestry, report on,	573
Number of acres in State reservations,	573
Destructiveness of forest fires,	574
Fruit Growers' Association of Adams County, proceedings of,	582
Officers of,	582
Fruit and fruit culture, report on,	507
Orchard management,	508
Fruit growing, essentials of success in,	597
Getting together,	598
Co-operation in,	599
Results of co-operation,	600
Business methods in,	601
Nursery methods of propagation in,	602
How to order trees,	603
Varieties in nursery stock,	605
Inter-cropping of young orchards,	606
Popularity of inter-cropping,	607
Growing of companion crops,	610
Some experiments with lime-sulphur,	611
Results of the experiments,	612

G

	Page.
Garden insects, how to control them,	452
Materials to use,	454
Names of,	456
Geology, report of Geologist,	563, 570
Clays and cement industry,	564
The limestones,	566
The formations,	570
Grapes, culture of,	639
Climate for,	639
Soil for,	640
Diseases of,	642
Value of,	643

H

Horse breeding for Pennsylvania farmers,	422
Breed to select,	424

I

Insects, life habits of brown tail moth,	667
History in Massachusetts,	668
How to destroy,	671
Institutes, farmers', report of Director,	27

L

Legislation, report of Committee on,	530
Taxation,	530
State fair,	532
Extermination of weeds,	533
Limestones, adaptability to manufacture of Portland Cement,	545
Statistics,	545
The different types of,	546
Principal types of coal measures,	548
Cements,	553
Livestock, report of Committee on,	527
Statistics of Pennsylvania,	527
Industry in Pennsylvania,	577
Meat animals,	577
Production of beef,	578
Feeding of,	579
Livestock Sanitary Board, officers of,	789
Lime-sulphur, making and use of concentrated,	645
Materials for,	646
Formula of,	647
Approximate results attainable,	648
Optimum concentration,	648
Time of boiling,	650
Process of diluting,	651
Use of sulphur sprays,	661
Influence of different strengths,	653
Utensils for making,	656
Development and chemical study of,	661
The color,	661
The commercial solutions,	663
Effects of carbonic gas on,	664

M

Market gardening, soil improvement for,	433
Tillage,	434
Stable manure,	435
Clover crops and green manure,	436
Irrigation,	438
Profit in,	439
Farm of late R. F. Schwarz,	695
Meadows and pastures, improvement of,	489
Experiments,	489
Results,	490
Yields of clover,	492
Yields of timothy,	493
Application of fertilizers,	496

	Page.
Milk, care of,	379
How to handle,	379
Vital problems before dealers in,	709
Cost of production, and maintenance of herds for purchase,	722
The feeding of dairy cows,	722
Cost of producing,	725
Miscible oils,	363
Making and application of,	363
The emulsions,	364
Their value and efficiency,	368

N

Nurseries, list of in Pennsylvania,	257
Licensed tree dealers,	263

O

Official list of department,	1
Orchard inspection by counties,	268
Orchard inspectors, report of,	292
Orchard demonstrations,	324
Orchard insects, how to control,	452
Materials to be used,	454
Losses from,	455
Orchard fertilization,	582
Experiments in,	583
Influence of fertilizers,	584
Financial value of fertilizers,	588
Experiments in,	588
Fertilization for different methods,	593
Massachusetts experiments,	595
Summary of suggestions,	596
Orcharding in Pennsylvania,	556
Orchards for commercial purposes,	352
Soil requirements,	354
Location of,	356
Preparation of soil,	356
Fertilizing for,	356
Age and shape of the trees,	358
Pruning,	359
When to prune,	369
Picking apples,	360
Packing apples,	361
Marketing,	361
Ornithologist, report of,	587

P

Peaches, practicable principles for profitable production of,	623
Soil and location for,	623
Varieties of,	623
Cultivation of,	624
Pruning and thinning,	624
Diseases and insects,	625
Experience with,	664
Kind of trees to plant,	672
Selection of trees,	673
Market for,	674
Pennsylvania Dairy Union, abstract of papers,	708
List of officers,	708
Pennsylvania State College, trustees and faculty of,	790
Officers and assistants,	793
Pennsylvania State Grange, officers of,	794
Pennsylvania Horticultural Society,	789
Pennsylvania Livestock Breeders' Association,	736
Abstract of proceedings,	736
Officers of,	736
Plant stimulant, effects of,	250
Pomology, report of Pomologist,	500
Orchard management,	500
Insecticides and fungicides,	501
Effect of soil on variety of fruits,	501
Fruit display at State College,	502

	Page.
Poultry keeping on the farm,	383
Why not successful,	384
Methods,	384
Feeding of,	386
Growing young chicks,	386
Poultry, light to them who sit in darkness,	387
The production of eggs,	389
The demands for Pennsylvania,	389
Profit in,	390
Construction of houses,	394
Report of Committee on,	543

R

Resolutions, report of Committee on,	751
Roads, the split road drag and its use in Pennsylvania,	427
Success of the King road drag,	431
Report of Committee on,	509
Work of State Highway Department,	509
Automobile licenses granted,	510

S

Sanitarian, report of,	486
Principles of sanitation,	487
Sheep, profitable farming of,	399
How to raise,	400
How to feed,	401
How to start a flock,	404
Selection of breed,	405
Care of,	406
Sheep demonstration,	742
Small fruit-culture,	433
Soil for,	433
Profit of,	439
Soil, conservation of nature's methods for maintaining soil fertility,	342
How to produce,	343
Distribution of,	343
Uses of water in,	349
How water may be lost,	350
Soil fertility, how maintained,	342
Few essentials of,	534
Available plant food for,	536
Soil moisture,	348
Spraying for San José Scale and Codling moth,	691
Brands of lime-sulphur,	621
Spraying mixtures and their value as fungicides,	683
Experiments,	685
Preparations of new sprays,	690
State Board of Agriculture, members of,	458
Papers read at meeting of,	462
State Horticultural Association, abstract of proceedings,	627
Officers of,	627
Report of General Fruit Committee,	627
State Livestock Sanitary Board, report of,	142
Work of meat hygiene,	143
Control of various diseases of animals,	150
Report of laboratory of milk hygiene,	166
Report of bacterial laboratory,	166
Report of experiment farm,	176
Report of outbreak of aphthous fever 1908 and 1909,	181

T

Tomatoes, experiments with,	706
Varieties of,	707
Marketing of,	707

V

Veterinarian, report of,	142
Work of meat hygiene,	143
Inspection of dairies,	147
Diseases of cattle and livestock,	150, 163
Report of milk hygiene,	165

	Page.
Report of bacterial laboratory,	166
Report of outbreak of foot-and-mouth disease, 1908-1909,	181
Extent of measures adopted by the State Livestock Sanitary Board,	185
The stamping out methods,	189
Methods of dealing with herds,	195
Dealings with infected premises,	196
Tracing the disease,	200
Inspection and quarantine,	200
Branch offices,	203
Inspections,	204
Summary of outbreak by districts,	206
Circulars issued,	230
W	
Wool and textile fibres, report of Committee on,	478
Statistics on,	478
Z	
Zoology, report of Zoologist,	248
Work of Bureau,	248
Inspection or nurseries,	254
List of nurseries,	257
Demonstrations,	263
Reports of orchard inspections, by counties,	268
Reports of orchard inspectors,	292
Making collections,	322



